United States Court of Appeals

for the

District of Columbia Circuit

TRANSCRIPT OF RECORD

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United States Court of Appeals for the District of Columbia

APRIL TERM, 1939

No. 7395 458

WILLIAM F. EPPENSTEINER, ALBERT HILLYER, AND THE AMERICAN METAL COMPANY, LIMITED, APPELLANTS,

vs.

CONWAY P. COE, COMMISSIONER OF PATENTS.

APPEAL FROM THE DISTRICT COURT OF THE UNITED STATES FOR THE DISTRICT OF COLUMBIA

FILED MAY 1, 1939

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United States Court of Appeals for the District of Columbia

APRIL TERM, 1939.

No. 7395

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United States Court of Appeals for the District of Columbia

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a District Court of the United States
for the District of Columbia

Equity No. 64962

William F. Eppensteiner, Albert Hillyer, and The American Metal Company, Limited, *Plaintiffs*

vs.

Conway P. Coe, Commissioner of Patents, *Defendant*

United States of America,
District of Columbia, ss:

BE IT REMEMBERED, that in the District Court of the United States for the District of Columbia, at the City of Washington, in said District, at the times hereinafter mentioned, the following papers were filed and proceedings had, in the above-entitled cause, to wit:

1 *Bill of Complaint*

Filed July 16 1937

In the District Court of the United States
for the District of Columbia

Equity No. 64962

William F. Eppensteiner, Albert Hillyer, and The American Metal Company, Limited, P. O. Address 61 Broadway, New York, N. Y., *Plaintiffs*

vs.

Conway P. Coe, Commissioner of Patents, *Defendant*

The Plaintiffs herein, for their bill of complaint, allege:

1. That the Plaintiff, William F. Eppensteiner, is a citizen of the United States and a resident of Rahway, in the

County of Union and State of New Jersey; that the Plaintiff, Albert Hillyer, is a citizen of the United States and a resident of Jamesburg Park, Helmetta, in the County of Middlesex and State of New Jersey; and that the Plaintiff, The American Metal Company, Limited, is a corporation duly organized under the laws of the State of New York, and domiciled in the City of New York, County and State of New York.

2. That the defendant, Conway P. Coe, is the Commissioner of Patents of the United States, a legal resident of the District of Columbia and is sued as Commissioner of Patents of the United States.

2 3. That this bill is filed in accordance with the provisions of the Federal Laws of the United States as provided for under Revised Statutes, Section 4915 as amended (U. S. C. Title 35 Sec. 63).

4. That the Plaintiffs bring this suit in their own right as set forth at length herein.

5. That the Plaintiffs, Eppensteiner and Hillyer as joint inventors, filed their application for a patent in the United States Patent Office for "Methods and Apparatus for Casting Copper" on August 21, 1934 which was given Serial No. 740,766. Said application was filed in accordance with the Laws of the United States and Rules of the Patent Office.

6. That on or about the 14th day of August 1934 by an instrument in writing, said Eppensteiner and Hillyer assigned the entire right, title and interest in and to said application and in and to the invention covered thereby to the Plaintiff, The American Metal Company, Limited, said assignment being recorded in the United States Patent Office on August 21, 1934 in Liber Q-160, Page 97.

7. That the said application has been duly prosecuted in accordance with the laws of the United States and the rules of the Patent Office.

8. That the application has been passed upon by the Primary Examiner who has refused to allow claims 16 to 22, which claims are as follows:

"16. The method of casting copper or similar metal in vertical molds to prevent pitting the mold and cold sets in the casting, which consists in pouring the metal in a

3 curved path toward the interior of the mold, catching the metal thus poured in a ladle before the metal strikes the interior of the mold and moving the ladle in a path downwardly into the mold to a point near the bottom thereof before the main stream of metal overflows the ladle.

17. In the method of claim 16, the step of preserving a pool of metal in the ladle well below the top thereof and permitting the exit of the metal at a point well below the top thereof when the ladle is near the bottom of the mold cavity.

18. In the method of claim 16, the step of moving the ladle upwardly along the curved path of the poured metal as the level of the metal in the mold increases.

19. A ladle for casting copper or similar metal in vertical molds, said ladle having a bowl open at its top to receive a stream of molten metal from the pouring device and provided with an imperforate bottom portion to contain a pool of metal as it is poured, and said bowl having an opening above said imperforate bottom portion through which opening metal flows to the interior of the mold, and said ladle having a shield portion extending well above said opening and leading into said bowl and adapted to substantially prevent splashing of metal out of said bowl into the interior of the mold.

20. A ladle for casting copper or similar metal in
4 vertical molds, said ladle having a bowl open at its top to receive a stream of molten metal from the pouring device and provided with an imperforate bottom portion to contain a pool of metal as it is poured, and said bowl having an opening above said imperforate bottom portion through which opening metal flows to the interior of the mold, and said ladle having a shield portion extending well above said opening and leading into said bowl and adapted to substantially prevent splashing of metal out of said bowl into the interior of the mold, and said shield portion extending around the top of the ladle and over said opening.

21. The ladle of claim 19 having a handle fixed firmly to the bowl of the ladle and extending generally in an upward direction from said bowl.

22. The ladle of claim 19 having a handle fixed firmly to the bowl of the ladle and extending generally in an upward

direction from said bowl, and a supplemental handle in fixed relation to the first and extending angularly from the same."

9. The Primary Examiner has finally rejected all of the above claims in accordance with the Rules of the Patent Office.

10. The Plaintiffs duly appealed from the decision of the Primary Examiner to the Board of Appeals, who affirmed the rejection of the Examiner in their decision dated January 19, 1937.

11. The Commissioner of Patents, by the Board of Appeals, contends that the subject matter defined in
5 claims 16 to 22 is not patentable in view of—

U. S. Patent to Walker	No. 597,367	Jan. 11, 1898
U. S. Patent to Hosack	1,375,589	Apr. 19, 1921
U. S. Patent to Chandler	1,983,578	Dec. 11, 1934
U. S. Patent to Ennor, et al	1,983,579	Dec. 11, 1934

12. The Plaintiffs disagree with these contentions of the Commissioner of Patents and contend that said invention is not anticipated by any disclosures of the prior art cited by the Commissioner of Patents, and in addition that it achieves a new, highly desirable and meritorious function not previously achieved by others. Plaintiffs also contend that said invention possesses the requisite utility to entitle them to a patent thereon.

13. The Plaintiffs further state that the said invention is new and useful and was not known or used by others in this country before the invention thereof by the Plaintiffs, Eppensteiner and Hillyer, and not patented or described in any printed publication in this or any foreign country before their invention thereof, or more than two years prior to their application for patent therefor, and not in public use or on sale in this country for more than two years prior to said application, and not patented in any foreign country by the Plaintiffs or by their legal representatives on an application filed more than twelve months prior to said application for Letters Patent, and has not been abandoned.

WHEREFORE, the Plaintiffs pray that the Honorable Court decree that the Commissioner of Patents be directed to allow said claims, and such other claims as upon hearing the Court may find patentable.

THE AMERICAN METAL COMPANY, LIMITED
By HEATH STEELE
Vice President
WILLIAM F. EPPENSTEINER
ALBERT HILLYER

N. C. TURNAGE
JOSEPH H. MILANS
E V MYERS
Counsel for Plaintiffs

6 *Verification*

STATE OF NEW YORK
County of New York *ss:*

On this 8th day of July 1937 personally appeared before me Heath Steele, Vice President of The American Metal Company, Limited, one of the Plaintiffs named in the foregoing bill and being duly sworn did depose and say that he is such Vice President; that he has read the foregoing bill; that the same is true to the best of his knowledge and belief, and that he executed the same on behalf of said The American Metal Company, Limited.

ADELINE B. ALLEN
(Notarial Seal) *Notary Public*
Kings County New York

Commission Expires March 30, 1939

Verification

STATE OF NEW JERSEY
County of Middlesex *ss:*

On this 13th day of July 1937 personally appeared before me William F. Eppensteiner and Albert Hillyer, two of the Plaintiffs named in the foregoing bill and being duly and severally sworn did depose and say that they have read the foregoing bill and that the same is true to the best of their knowledge and belief.

T. R. GRUENING
(Notarial Seal) *Notary Public of New Jersey*

My commission expires April 22, 1940.

7 *Answer to the Bill of Complaint.*

Filed July 23 1937

* * *

To the Honorable the Judges of the District Court of the United States for the District of Columbia.

Conway P. Coe, Commissioner of Patents, defendant herein, in answer to the bill of complaint alleges on information and belief as follows:

1. He admits the allegations of the citizenship and residence of the respective plaintiffs, William F. Eppensteiner and Albert Hillyer, and the allegation of the incorporation and place of business of the plaintiff, The American Metal Company, Limited.

2. He admits the allegation of his official position but avers that while he is an official resident of the District of Columbia, his legal residence is in the State of Maryland.

3. He admits the allegations of paragraph 3.

4. He admits that plaintiffs have a right to bring this suit.

5. He admits that plaintiffs, William F. Eppensteiner and Albert Hillyer, alleging to be joint inventors for "Methods and Apparatus for Casting Copper", filed an application for patent thereon on August 21, 1934, which application was given Serial No. 740,766.

6. He admits the allegation of assignment by the plaintiffs, Eppensteiner and Hillyer, to the plaintiff, The American Metal Company, Limited.

7. He admits that the application was duly prosecuted.

8. He admits that the primary examiner rejected
8 claims 16 to 22, inclusive, as set out in paragraph 8
of the bill.

9. He admits that the primary examiner finally rejected the said claims.

10. He admits that the applicants appealed from the decision of the examiner to the Board of Appeals of the Patent Office and that the Board of Appeals affirmed the action of the primary examiner.

11. He admits that the references cited were as stated in paragraph 11.

12. He admits that the plaintiffs disagree with the holdings of the Patent Office but denies that plaintiffs are en-

titled to a patent containing the claims set out in paragraph 8 of the bill since these claims are deemed to be unpatentable over the following prior art and for the reasons given in the statement of the examiner in answer to the appeal and the decision of the Board of Appeals, copies of which will be furnished at the trial:

Walker,	597,367,	Jan. 11, 1898,
Hosack,	1,375,589,	Apr. 19, 1921,
Chandler,	1,983,578,	Dec. 11, 1934,
Ennor et al.,	1,983,579,	Dec. 11, 1934.

Profert of copies of these patents is hereby made.

13. He admits that the plaintiffs, Eppensteiner and Hillyer, made in their application for patent averments corresponding to the allegations of paragraph 13, but denies that these allegations are sufficient to justify granting a patent on said application containing the claims set out in paragraph 8 of the bill.

WHEREFORE defendant having fully answered the bill
of complaint denies that plaintiffs are entitled to the relief
demanded or any part thereof and prays that the bill
9 be dismissed with all costs of the proceedings against
the plaintiffs as provided in Section 4915 R. S.

CONWAY P. COE
Commissioner of Patents,
Defendant.

R. F. WHITEHEAD
Solicitor of the Patent Office,
Attorney for Defendant.

DISTRICT OF COLUMBIA: *ss.*

I, Conway P. Coe, Commissioner of Patents, depose and say that I have read the above answer by me subscribed and know the contents thereof, and that the statements of facts therein made as upon personal knowledge are true, and those made upon information and belief I believe to be true.

CONWAY P. COE
Commissioner of Patents.

Subscribed and sworn to before me this 22nd day of July, 1937.

ALICE M. KENNEDY
(Notarial Seal) *Notary Public, D. C.*

My commission expires Oct. 15, 1940.

Memorandum

February 20, 1939

Oral finding for the defendant.

10

Findings of Fact.

Filed March 13 1939

* * *

1. This is a suit brought under the provisions of Section 4915 R. S. (U. S. C., title 35, sec. 63), by which it is sought to have the Commissioner of Patents authorized to issue to plaintiff The American Metal Company, Limited, as assignee of the application of William F. Eppensteiner and Albert Hillyer, Serial No. 740,766, filed August 21, 1934, a patent containing claims 16 to 22, inclusive.

2. The application of Eppensteiner and Hillyer discloses a process of casting copper and a ladle to be used in the carrying out of said process. The copper is poured from an overflow type of furnace ladle into a vertical mold through a pouring spout, flowing into the mold in a curved path. A ladle in which a pool of metal accumulates is held beneath the stream of copper and lowered into the mold at such a rate that no metal flows therefrom until the ladle reaches the bottom or near the bottom of the mold. The ladle is formed with an overflow opening in one side. The portion of the ladle extending above the opening serves as a shield and prevents splashings of the metal from hitting the sides of the mold and forming so called "cold sets". This process has been extensively used by the plaintiff, The American Metal Company, Limited, which in using the invention has cast in the neighborhood of three hundred seventy-five million pounds of copper in the form of between eight hundred thousand and nine hundred thousand separate copper cakes.

3. That according to the application of Eppensteiner & Hillyer the vertical molds are of considerable height so that the molten metal has a long drop which would result in the pitting of the mold bottom but this is prevented by the practice of the process at bar; also, the casting cavity is narrow so that vertical cakes or plates may be cast therein.

11

4. Claims 16, 17 and 18, of the application in suit, are for the process, and claims 19, 20, 21 and 22 are for the ladle.

5. The Hosack patent, No. 1,375,589, discloses an appliance for casting metal ingots in molds and describes and claims the process of casting metal from a ladle. It is stated in the specification of this patent that the primary object is to diminish or obviate splashing of the metal. There is shown and described a counterbalanced pilot ladle into which metal is received from the pouring ladle. The pilot ladle is shown as having an opening at the bottom and a series of other openings above it. It is stated in the specification that the ladle may have a stopper to control the discharge operated by hand, or automatically operated by striking the bottom of the mold when the pilot ladle is near the bottom thereof. It is also stated that instead of being arranged to operate automatically, the pilot ladle may be moved down and up into and out of the mold by hand operated means, and that when the pilot ladle is carried down to near the bottom of the ingot mold the metal from the pilot ladle flows in a quiet stream or streams from the opening in the bottom of, or from the openings in both the bottom and the side wall of the pilot ladle into the bottom of the mold.

6. That Hosack does not disclose apparatus capable of pouring metal in a curved path into the interior of the mold, nor a control means for the ladle capable of causing the ladle to move in a curved path from the top of the mold to the bottom thereof.

12 7. The patent to Ennor et al., No. 1,983,579, discloses a system of transferring molten metal by means of a siphon from one container to another and shows and describes a diffusing and dross collecting device consisting of a bowl into which the molten metal flows through the siphon pipe and overflows the sides of the bowl. The bowl is provided with a plate or baffle surrounding the bowl and supported by the siphon pipe in spaced relation to the bowl.

8. The patent to Chandler, No. 1,983,578, discloses a metal transfer device consisting of a trough having a deepened reservoir portion to which one or more baffle plates are affixed, said trough, when used, extending through the side of an open side type mold. A weir is formed at the

lower end of this reservoir. The molten metal is poured into the upper end of the trough and passes under the baffle and over the weir into the mold which is placed below the lower end of the spout.

9. The patent to Walker, No. 597,367, discloses an apparatus for casting metals in cake, ingot, and wire-bar molds and in which, in order to ensure delivery of the metal to the mold and "obviate all liability of clinging, splashing or 'cold setting' ", the metal is flowed directly from the ladle to a guide or deflector which is provided with a handle, the pouring being such that on account of the inconsiderable fall of the metal, it cannot splash or chill. In figure 6 of the drawing of the patent several forms of this deflector are shown. In one of these forms, which is for use with ingot molds, the deflector is provided with pouring lips at its opposite sides.

Conclusions of Law.

1. The process claims Nos. 16, 17 and 18 define no invention over the Hosack patent No. 1,375,589.

13 2. The article claims Nos. 19, 20 and 21 define no invention over the disclosures of the patents to Walker, No. 597,367, Chandler, 1,983,578, and Ennor et al., No. 1,983,579.

3. Article claim 22 is not patentably different from claim 15, which was allowed by the Patent Office and which reads as follows:

15. A ladle for casting copper or similar metal in vertical molds, said ladle having a bowl, a main handle extending generally upward from said bowl and a supplemental handle arranged between the bowl and the upper part of the main handle, said supplemental handle being connected to the main handle at an angle thereto.

4. The plaintiff, The American Metal Company, Limited, is not entitled to a patent on the application in suit containing claims 16, 17, 18, 19, 20, 21 and 22.

5. The bill of complaint should be dismissed.

DANIEL W. O'DONOGHUE
Justice.

Mch. 13th 1939

Judgment.

Filed March 13 1939

* * *

This cause having come on to be heard and having been tried in open court and argued by counsel for the respective parties upon the pleadings and proofs adduced and submitted to the Court,

It is ADJUDGED, this 13th day of Mch., 1939, that the Bill of Complaint in this case be, and the same hereby is dismissed with costs against the plaintiff.

DANIEL W. O'DONOGHUE
Justice.

Approved as to Form:
JOSEPH H. MILANS
Attorney for Plaintiffs.

14

Notice of Appeal

Filed March 28 1939

* * *

Notice is hereby given that William F. Eppensteiner, Albert Hillyer, and The American Metal Company, Limited, the plaintiffs above named, hereby appeal to the United States Court of Appeals for the District of Columbia from the final judgment entered in this action on March 13, 1939.

JOSEPH H. MILANS
Attorney for Appellants

WILLIAM F. EPPENSTEINER,
ALBERT HILLYER, and
THE AMERICAN METAL COMPANY, LIMITED.

Stipulation Re Bond

Filed March 28 1939

* * *

In the above-entitled case, in the matter of appeal to the United States Court of Appeals for the District of Columbia, it is stipulated that the sum of One Hundred Dollars ($100) in cash may be deposited with the Clerk of this Court in lieu of bond for costs on appeal as provided by Rule 73 (c), *Rules of Civil Procedure.*

JOSEPH H. MILANS
Attorney for Plaintiffs

R. F. WHITEHEAD
Attorney for Defendant.

Approved: March 28th, 1939.
DANIEL W. O'DONOGHUE
Justice.

Memorandum

March 13, 1939

$100.00 deposited by Jos. H. Milans in lieu of bond on appeal.

15

Stipulation

Filed April 28, 1939

* * *

It is hereby stipulated by and between counsel for the parties to the above-entitled action, that the accompanying transcript of testimony, to be used in the certified transcript of record for perfecting the Eppensteiner et al. appeal to the Court of Appeals of the United States for the District of Columbia, is a complete and correct copy of the testimony given in open court on February 20, 1939; that the accompanying certified copy of the petition, specification, oath, and drawing, as originally filed, in the matter of the pending application of William F. Eppensteiner and Albert Hillyer, on August 21, 1934, Serial No. 740,766 (Plaintiffs' Exhibit 1); the certified copy of the appeal to the Board of Appeals, filed April 14, 1936 (Plaintiffs' Exhibit 2); certified copy of Examiner's statement, dated May 1, 1936 (Plaintiffs' Exhibit 3); and certified copy of decision by the Board of Appeals, dated January 19, 1937 (Plaintiffs' Exhibit 4), are the paper exhibits offered by

plaintiffs and duly received in evidence; that the four copies of patents to Walker, No. 597,367; Hosack, No. 1,375,589; Chandler, No. 1,983,578; and Ennor et al., No. 1,983,579 (Defendant's Exhibits 1-A, 1-B, 1-C, and
16 1-D) are the patent exhibits offered by defendant and duly received in evidence; that all of said enumerated exhibits are to be included in the certified transcript of record for appeal; and that in view of the fact that Defendant's Exhibits 1-E, 1-F, and 1-G are duplicated in Plaintiffs' Exhibits 1, 3, and 4, they need not be included in the transcript; and

That the other exhibits, to-wit Exhibits 5 to 21, inclusive, introduced on behalf of Plaintiffs, being in the main physical exhibits, and in instances enlarged prints or photostatic copies of drawings otherwise appearing as exhibits, it is agreed that said Plaintiffs' Exhibits 5 to 21, inclusive, may be omitted from the transcript and retained by counsel for placing in the custody of the Clerk of the Court of Appeals prior to the hearing on appeal, as is customary.

JOSEPH H. MILANS
Attorney for Eppensteiner et al.

R. F. WHITEHEAD
Solicitor for the Commissioner of Patents

April 28, 1939

17 Monday, February 20, 1939.

Filed Apr 28 1939

Transcript of Proceedings

Testimony of Daniel Latimer Ogden, Robert Winters

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19 Mr. Engel. If your Honor please, I shall now offer in evidence a certified copy of the application as filed, and this will be Plaintiffs' Exhibit 1.

(Certified copy of application as filed was marked as Plaintiffs' Exhibit 1 and received in evidence.)

Mr. Engel. I now offer in evidence a certified copy of the appeal to the Board of Appeals, as Plaintiffs' Exhibit 2.

20 (Certified copy of appeal to the Board of Appeals was marked as Plaintiffs' Exhibit 2 and received in evidence.)

Mr. Engel. I now offer in evidence as Plaintiffs' Exhibit 3 the Examiner's certified copy of the Examiner's Statement on Appeal.

(Examiner's certified copy of Examiner's Statement on Appeal was marked as Plaintiffs' Exhibit 3 and received in evidence.

Mr. Engel. I offer now in evidence a certified copy of the decision of the Board of Appeals.

(Certified copy of decision of Board of Appeals was marked as Plaintiffs' Exhibit 4 and received in evidence.)

Mr. Engel. If your Honor please, I now wish to present Mr. Daniel L. Ogden as a witness.

Evidence on Behalf of the Plaintiffs

Thereupon **Daniel Latimer Ogden** was called as a witness and, having been first duly sworn, was examined and testified as follows:

Direct Examination

By Mr. Engel:

Q. Will you please state your full name? A. Daniel Latimer Ogden.

Q. What is your address or residence? A. Woodbridge, New Jersey.

Q. What is your profession or occupation? A. Metallurgical and chemical engineer.

Q. By whom are you employed? A. By the United
21 States Metals Refining Company, a subsidiary of
The American Metal Company.

Q. How long have you been employed by the said employer? A. I have been employed fourteen years.

Q. Will you kindly state the nature of your employment with the said company from its inception to the present time? A. Well, for about the first six years I was with the research department of the company; for the following four and one-half years I was production superintendent; since that time I have been general superintendent of the plant.

Q. Are you familiar with the various modes of casting copper, and particularly with the casting of copper in vertical molds of substantial height? A. I am.

Q. Will you kindly explain the problems of casting copper in vertical molds of substantial heights? A. In vertical molds of substantial height one of the primary difficulties encountered is the pitting of the bottom of the mold due to the hot metal impinging on them, due in turn to the considerable drop of the metal. The second difficulty is the splattering of the metal as it hits the bottom until a pool of sufficient depth is formed to absorb the shock of the metal. This splattering would come in contact with the cold or cool walls of the mold and adhere to the walls in solid form. These cold sets or splatters thus formed would not redissolve in the copper, due to the low temperature at which the copper has to be cast, and thus would form imperfections on the face of the casting, which are detrimental to the copper after it has been rolled, and 22 also at times would wedge between the cake itself and the walls of the mold, preventing the easy removal of the cake from the mold.

Q. Are you familiar with the method and apparatus for casting copper, disclosed in the Eppensteiner and Hillyer application for patent, No. 740,766, which is in issue in this case? A. I am.

Q. Is the said invention being practiced by the United States Metals Refining Company at the present time? A. It is.

Q. Will you briefly describe the invention in question with reference to the drawings of the patent application and the enlarged photostatic copy, which I show you herewith? A. The invention itself consists of a ladle so made that the length is at least three times the width, and having a lip of some type or other which is lower than the side walls—substantially lower than the side walls—which permits the copper to flow from the ladle in one direction, and permits the side walls of the ladle to act as a shield, to prevent any splashing or splattering from leaving this ladle and coming into contact with the side walls of the mold.

The ladle itself is the portion as in figure C, the side walls being considerably higher—that is, the depth from here to here (indicating)—being considerably higher—than the point of overflow which is in this case.

As I said before, it permits the flow of metal in the one direction from the front of the ladle to the bottom of the mold, and in this case into the bottom of the mold through a channel.

23 Mr. Myers. May I ask that the witness state what he means by "this place" or "that place"? There will be nothing on the record, otherwise, to show what is meant.

The Witness. It flows through the opening, as shown at F in figure C, and shown at F-prime at figure 5. I mean, pardon me, at F in figure 3, not C.

In use, this ladle is held under the furnace or pouring ladle, as at 1 in figure 1. It intercepts a stream at that point, forming a small pool. The invention is then lowered, or the ladle is then lowered, gradually to the bottom of the mold, the ladle filling as it is lowered, forming a cushion, so that a minimum of splattering of any kind will occur.

When the ladle reaches the bottom of the mold, it is filled to the point of overflow and then flows to the bottom of the mold without any appreciable drop, allowing the metal to run smoothly over the surface of the mold and preventing splattering in any direction in the bottom.

Q. What takes place after a substantial pool of metal has formed in the bottom of the mold? A. After a substantial pool of metal has formed in the bottom of the mold, the ladle is removed, since this pool that has formed absorbs the shock of the metal and prevents splattering.

The ladle is then removed from the mold, any excess metal having been removed from it—molten metal removed from it—and the ladle after removal contains a scum of solidified copper the shape of the ladle, and this has to be removed from the ladle after each casting.

The ladle is then cooled by being submerged in
24 water containing bone ash. This operation cools the
ladle and at the same time recoats it with bone ash
for the next operation.

By Mr. Engel:

Q. Is pouring of copper from the furnace ladle into the mold continued after the casting ladle, which you have described, is withdrawn from the mold? A. Yes, the copper is continued to be poured continuously into the mold until it reaches the depth required for the size of cake that is being cast. Then the copper is filled over the mold.

Mr. Engel. I offer in evidence, your Honor, this enlarged photostatic copy of the drawings of the Eppensteiner and Hillyer application involved.

(Enlarged photostatic copy of drawings of Eppensteiner and Hillyer application was marked as Plaintiffs' Exhibit 5 and received in evidence.)

By Mr. Engel:

Q. Mr. Ogden, as superintendent of The United States Metals Refining Company plant at Carteret, New Jersey, can you give any idea of the quantity of copper which has been cast in your plant by the use of the invention at bar? A. In the neighborhood of 375 million pounds.

Q. Approximately how many separate cakes would that amount to? A. Between eight hundred thousand and nine hundred thousand.

Q. Did all those cakes require the use of a manual operator in their casting? A. That is correct.

25 Q. How does this casting compare with prior
methods of casting copper? A. In the prior method
of casting copper, the cakes were cast in a shallow mold, around four to five inches deep, from a pouring or furnace ladle with relatively large lips, and the metal would flow in in large volume, covering the bottom very quickly, and with little or no tendency to splash. Occasionally the metal at the beginning of the pouring would wash up on the sides of the mold, and a man was used to turn that copper back into the molten metal so that it would re-dissolve, and that man was known as a fisher; but in the casting of vertical cakes the copper drops a distance of twenty or more inches into the mold in a narrow stream that must be of such di-

mensions that it will not come in contact with the sides of the mold, the mold being approximately four inches in width, or thick, and this narrow stream dropping through the twenty or more inches impinges upon the bottom, eroding away the bottom and also at the instant of coming in contact with the solid surface splatters, forming definite cold spots, which in contact with the cool wall of a mold will not re-dissolve in the molten copper as the mold fills up.

Q. Will you briefly describe the casting of the so-called wedge cakes? A. The wedge cakes are cast in a manner similar to the flat cakes. The copper is poured into the shallow molds, which have a depth of, oh, probably twelve inches, and in a large stream the bottom of these fill very rapidly, but in these cakes, too, there is a certain amount of cold sets and splashes that occur, and in those a fisher is
used to turn them back into the metal. Because of
26 the shallow depth, they can be easily seen and handled by the fisher.

In the vertical cakes that is not true, because of the great depth, and a man can't get at the bottom of the mold.

Q. What is the primary objection to the flat cakes? A. The primary objection to the flat cakes is the side or oxide surface which occurs on the largest surface of the cake, and which either has to be scalped before delivery, in order to get a fine surface to the finished sheet, or if not scalped would create a mottled effect on the surface, also causing blemishes and blisters due to rolled-in oxide and scale, and it became very undesirable for the sheet trade.

Q. What was the primary objection to the wedge cakes? A. The primary objection to the wedge cakes was the fact that extra expense had to be entailed in rolling. Several passes in the mill had to be given before the wedge cake was rolled to a parallel side slab, and also in the wedge cake the oxidized or set surface of the cake came along the long side, and the rolled sheet had to be trimmed off, giving considerable scrap, which was objectionable to the rolling mill.

Q. How does the quality of the flat cakes and the quality of the wedge cakes compare wth those cakes which are cast in accordance with the present invention in vertical molds having parallel sides, and using the method and apparatus of the present invention. A. The vertical-cast cake is much superior to either the wedge- or flat-cast cake for the reasons already given.

27 Q. How does the practice of the present invention, or how has the practice of the present invention, affected the production of flat cakes at your plant? A. Since the inception of this invention the casting of flat cakes has entirely disappeared in the plant, and at the present time the entire production of copper cakes is in vertical mills using the present invention.

Q. Can you state the approximate measurements or sizes of the cakes which you cast with the present invention, with particular regard to the width and depth of molds having the same dimensions as the cakes? A. In the present invention cakes are cast four to five inches thick with a width of anywhere from thirteen inches to thirty-eight or forty-two, inches, and with a depth from eighteen and a half or twenty inches up to forty-eight inches or even larger in some cases.

Q. When you cast these cakes of extreme depth—say upward of forty inches—did you experience any defects, such as the mold pitting, or spattering and cold sets at the bottom of the cakes? A. The deeper the cake, the more intense the pitting and the greater the amount of spattering occurs, due to the initial drop of copper against the flat surface in the bottom of the mold.

Q. Did the use of the present invention obviate that pitting and cold setting? A. It did, and it wasn't until the use of the invention occurred that we were able to cast the extreme-depth cakes.

28 Mr. Engel. At this time I think it would be quite enlightening to the Court to see the manner in which the invention is carried out in actual practice. We have had made a film which will take about eight or nine minutes to show, and it discloses the particular problems and the manner of their solution as embodied in the present invention.

With your Honor's kind indulgence, we should like to show those pictures.

The Court. Very well.

Mr. Engel. While the operator is setting up his apparatus, I shall continue with the examination.

By Mr. Engel:

Q. Mr. Ogden, will you kindly state what you had to do with the preparation of the pictures which are about to be shown? A. I directed the taking of the pictures.

Q. You directed their taking? A. Yes.

Q. Who actually photographed them? A. Mr. Winters, the gentleman who will show the pictures, actually did the work.

Q. By whom were those pictures developed? A. They were developed by the Eastman Kodak Company, at Rochester.

Mr. Engel. Would your Honor declare a recess for about ten minutes while the apparatus is being set up?

The Court. Very well.

(At this time a short recess was taken, at the conclusion of which the proceedings were resumed as follows:)

29 Mr. Engel. May it please the Court, I should like to have the Court's consent to have the witness repair from the witness stand to the motion picture screen in the rear of the court room, where he will describe some of the scenes as they are portrayed.

The Court. Very well.

Mr. Engel. Proceed with the showing of the pictures.

(At this time a motion picture was shown in the court room. The witness left the witness chair and went to the motion picture screen. The following then occurred:)

The Witness. The first scene is a general view of a casting wheel, as copper is cast in vertical castings.

The second scene is a closeup showing the copper falling into the mold and showing the splashing in the bottom of the mold. Notice the cold sets forming on the bottom of the mold.

This is a duplicate, showing the splashing. Notice the cold sets forming on the side wall of the mold. They are shown cooling in black.

In this picture the side of the mold has been cut away to show the fall of the metal into the mold. It shows the splashing as the copper hits the bottom of the mold.

This is another picture, looking down under the mold, showing the splashing.

This is purely a demonstration of the casting or the stream hitting the flat surface from a height. As the copper hits, it splashes around the bottom and sides of the mold, and as the depth at which the stream pours
30 increases, the amount of splash also correspondingly increases.

This is a picture of the casting ladle as it is now used.

This view shows a method of handling the casting to prevent splashing.

This view, with the side cut away, is a demonstration of the lowering of the ladle into the stream and also the quietness with which the stream falls into the ladle.

This shows the normal mold and the method of pouring copper. Notice the pool forming as the ladle is lowered into the cavity of the mold. By the time the ladle is in place, the pouring is completely filled.

In these pictures the filling of the mold is not shown completely. This shows the general application of the invention at bar and shows the individual men at each mold with a casting ladle.

This shows the casting ladle within the mold cavity, the method of removing the ladle from the cavity, and the removal of the skull which formed in the ladle at each casting.

The final view is that of the copper cake as cast by this process.

(The showing of the picture was completed, and the witness returned to the witness stand. The following then occurred:)

By Mr. Engel:

Q. Mr. Ogden, with reference to the motion pictures which have just been shown to the Court, can you state unequivocally that they depict the mode of casting cop-
31 per as now practiced at your plant; that is, the pictures showing the solution of the problem and particularly the casting on the casting wall? A. I can.

Q. In the pictures there was disclosed as a part of the invention a casting ladle. I show you here one such ladle and ask you to state whether this is a true type or actual ladle which is used in the casting process according to the invention. A. It is.

Q. Will you please describe this ladle with particular reference to the bowl? A. The shielded and the discharge passage of the ladle—the bowl of the ladle—is semi-circular in form, narrow in width, of dimensions such that it will fit in the cavity of a vertical casting mold, and having a length approximately twice its width, and having the side walls extend above the sides, and the back wall extending substantially above the front wall, thereby forming a passage for the metal to flow out of the ladle before the ladle can become completely full, and permitting the side and back walls to act as the shield to prevent the metal from overflowing to the side, and preventing any appreciable splashing from occurring, or rather from going out of the ladle against the side walls of the mold.

Mr. Engel. I offer in evidence this ladle as Plaintiffs' Exhibit 6.

(The ladle referred to was marked as Plaintiffs' Exhibit 6 and received in evidence.)

32 By Mr. Engel:

Q. In your comments bearing on the showing of the pictures, you made reference to the removal of a skull from the ladle after the casting operation. I show you here a so-called skull and ask you identify it and to state from what type of ladle it was obtained. A. Well, that is the common skull—so-called skull—a mass of copper that congeals on the inside of the ladle during the pouring operation, and that particular skull was obtained from a ladle of the exact type that was shown.

Q. Is this skull formed after or during a single casting operation, or is it an accumulation of copper resulting from a number of casting operations with the ladle? A. That skull is formed on each individual operation of the ladle.

Mr. Engel. I introduce this skull in evidence as Plaintiffs' Exhibit 7.

(The skull of copper referred to was marked as Plaintiffs' Exhibit 7 and received in evidence.)

Mr. Engel. That will be all, your Honor.

Mr. Whitehead. I have no cross-examination.

(The witness left the stand.)

Mr. Engel. Mr. Winters.

Thereupon **Robert Winters** was called as a witness and, having been first duly sworn, was examined and testified as follows:

33 Direct Examination

By Mr. Engel:

Q. Please state your full name. A. Robert Winters.

Q. Where is your residence? A. Rahway, New Jersey, 513 West Meadow Avenue.

Q. What is your profession or occupation, Mr. Winters? A. Safety engineer.

Q. By whom are you employed? A. By the United States Metal Refining Company.

Q. Located where? A. Carteret, New Jersey.

Q. Will you briefly describe the nature of your duties as safety engineer? A. Well, the duties of a safety engineer are to inspect all machinery operations, correcting unsafe conditions, to maintain an organization within the plant, insofar as safety is concerned, such as safety committees, organizing safety drives, and in general maintaining that part which is conducive to the prevention of accidents to employees.

Q. In addition to your duties as safety engineer do you have any other duties at the plant of the United States Metals Refining Company? A. Yes, sir.

Q. State those briefly. A. I am employment manager, and I am in charge of plant protection, the fire department, and the police department.

Q. Do your duties also embrace the taking of any
34 pictures? A. They do. The pictures are usually taken also in connection with unsafe conditions pertaining to prevention of accidents.

Q. How much experience have you had in the taking of such pictures? A. Oh, I would say fifteen years on still pictures, and two years on motion pictures.

Q. Did you personally take the pictures which were shown on the screen here a short while ago? A. I did.

Q. Do those pictures truly represent the scenes as photographed? A. They do.

Mr. Engel. That will be all.

Mr. Whitehead. I have no cross-examination.

(The witness left the stand.)

Mr. Engel. The plaintiff closes.

Mr. Whitehead. I am simply going to introduce this folder in evidence, a copy of which you have.

Your Honor has heretofore ruled that it was part of the plaintiffs' case to put in any testimony he chose to put in—

The Court. Are there any further witnesses?

Mr. Engel. I did not understand that the Commissioner would introduce those formal references in evidence without comment; I expected that there would be comment on them, and we intended to rely on our rebuttal to controvert any statements in those references.

The Court. Well—

Mr. Whitehead. I have no objection.

35 The Court. Then, Mr. Whitehead, you, in behalf of the defendant, offer in evidence—

Mr. Whitehead. This folder, which is Defendant's Exhibit 1.

The Court. Defendant's Exhibit 1 is the folder with the index from A to G.

(Folder entitled "Eppensteiner, et al. v. Coe" was marked as Defendant's Exhibit 1, was received in evidence, and is indexed as follows:)

"Eppensteiner, et al. v. Coe.

Equity No. 64,962.

A—Walker,	597,367
B—Hosack,	1,375,589
C—Chandler,	1,983,578
D—Ennor et al.,	1,983,579
E—Print of Drawings,	
F—Statement of the Examiner,	
G—Decision of the Board of Appeals."	

The Court. That has been admitted in evidence as Defendant's Exhibit 1. Has the defendant any further exhibits?

Mr. Whitehead. I have no further exhibits.

The Court. Have you any further testimony?

Mr. Whitehead. I have no testimony.

Mr. Engel. Under the circumstances, your Honor, I should like to recall Mr. Ogden to the stand.

The Court. Very well.

36 *Evidence in Rebuttal on Behalf of the Plaintiffs*

Thereupon **Daniel Latimer Ogden** was recalled as a witness in rebuttal and, having been previously duly sworn, was examined and testified further as follows:

Direct Examination

By Mr. Engel:

Q. Mr. Ogden, have you read over the file history of the patent application covering the present invention and the references cited by the Examiner? A. I have.

Q. Do you understand the same? A. I do.

Q. I show you here a copy of a patent to Chandler, No. 1,983,578, introduced as Defendant's Exhibit 1-C, and ask you whether you have read it and understand it. A. I have read over the patent and understand the application of it.

Q. Would you say that the invention disclosed therein is at all similar to the invention at bar? A. In my opinion, it is not.

Q. Will you kindly describe briefly the invention disclosed in that Chandler patent? A. The Chandler patent discloses a vertical mold having one side removed, and that side has been replaced by a belt. No ladle is in evidence in the patent, but it shows a pouring trough through which the metal passes to the mold.

In operation the mold is brought up by means of
37 a hydraulic piston or mechanical arrangement until
it is almost at the top of the belt, at which point the end of the trough is at or almost touching the bottom of the mold.

The metal is then poured down this trough and flows under an inverted dam, which is used to restrain dross from entering the mold, and then overflows from the edge of the trough into the mold proper.

There is no appreciable drop between the edge of the trough and the bottom of the mold at the start, and from the disclosure in the patent the edge of this trough remains submerged to some extent in the metal being poured into the mold.

As the mold fills up, it is lowered by means of the mechanical arrangement, maintaining the end of the trough in or at the surface of the metal, so that at no time is there a drop of the metal from the trough to the surface of the metal at the mold.

Q. With respect to what metal does the casting in the Chandler patent apply? A. Well, it is apparent that the Chandler patent refers to the casting of aluminum.

Q. Would you say that the problems in casting aluminum are at all analogous to the problem of casting copper cakes? A. To my knowledge, they are not.

Q. You stated in your explanation of the Chandler patent that considerable dross is formed. What do you mean by dross? A. Well, aluminum is very susceptible to the pick-up of oxygen from the air, in a molten condition, and
the formation of aluminum oxide occurs very read-
38 ily. This aluminum oxide is the so-called dross or
slag that is on the surface of the metal.

Q. Would you say that there is any substantial or considerable drop of the metal from the furnace ladle to the mold in the Chandler patent? A. There is not.

Q. I hand you a copy of the patent to Ennor et al., No. 1,983,579, which has been introduced as Defendant's Exhibit 1-D, and ask you whether you have read over that patent and understand it. A. I have, and I understand it.

Q. Will you briefly describe what the invention relates to? A. This invention is also a means of casting aluminum and consists of a siphon which siphons the metal from a traveling ladle or a crucible by means of a pipe which terminates in a cylindrical vessel having a semi-circular or having, rather, a circular sphere under it, forming a cup into which the metal falls from the siphon pipe and travels in all directions, and having a shield which dips down into the metal to prevent the dross from circulating in the mold and coming in contact with the side of the mold.

In this case also the mold moves down as it fills, apparently mechanically.

Q. You spoke of a siphoning action of the metal from the main ladle to the transfer ladle. Will you kindly explain

what you mean by that? A. Well, it is apparently a metal
pipe having one long leg which reaches to the bottom
39 of the mold, and a short leg which is inserted into
the transfer ladle or crucible, and this siphon is started by plunging a weight into the transfer ladle, raising the metal until it is higher than the upper return bend of the siphon, thereby forcing the flow of metal into this tube, and once the metal has passed the return bend of the siphon it automatically, of its own weight, continues to fall. That is, its own weight in the siphon continues to fall.

Q. Could a siphoning action as shown in the Ennor patent be employed in the casting of copper? A. It certainly could not.

Q. Why not? A. Because of the high temperature at which copper is cast and the corrosive effect of commercial copper as cast; and also due to the small differential in temperature between the solidification point of the copper and the casting temperature, the copper would not flow through the siphon.

Q. You say it would not flow through the siphon. If the siphoning action is dependent upon the differential in the levels of the two liquids, why would it not flow through? A. Because of the fact that the difference in temperature is so small that the metal would immediately solidify on entering the tube.

In the first place, it would be necessary, if it were possible, to heat the pipe up to a very high temperature, which would cause a softening of the pipe and at the same time bring it to a temperature at which there would be corrosion
of the pipe by the small amount of oxide in the cop-
40 per, and it could only last for a short period, and in
order to prevent this action, both in molds and transfers, the metal handling the copper is kept at a low temperature, and of necessity skulls form, which will fill up in a pipe and completely close it in a very short period.

Q. You stated that the bowl in the Ennor patent is always at the bottom of the mold. Hence, is it at all possible to catch the metal at the top of the crucible or the furnace ladle, if such were used, and conduct it down to the bottom of the mold, as is done in the invention at bar? A. No, it could not.

Q. When the metal is caught in the bowl within the mold of the Ennor patent, what would happen if any spattering took place? A. The spattering would collect on the outer shield and gradually close in the passageway that may be there, through solidification.

Q. I hand you a copy of the patent to Hosack, No. 1,375,589, introduced as Defendant's Exhibit 1-B, and ask you to describe it. In doing so, I should like you to make reference to the enlarged photostatic copy of the drawings which I show you. Please describe the invention. A. In figure 1 the ladle or distributor, A, is supported by means of a cable extending over two wheels; that is, over two wheels, one on each side of the ladle and counterbalanced by a counterbalanced weight, D.

These wheels are fastened to the bottom of the large transfer ladle containing the metal to be cast, which is dis-
closed in this particular case as steel. At the begin-
41 ning of the operation the valve at B, in the bottom
of the large transfer ladle, is opened, and the molten
metal then runs into the small ladle, A, which contains a bottom opening and a number of openings around the side.

Immediately when the metal enters A a portion of that metal is discharged through the opening in the bottom and falls to the bottom of the mold. At the same time a portion of the metal accumulates in A, and the weight of that metal causes the ladle, A, to descend into the mold.

When this ladle reaches the surface of a liquid pool which is formed in the bottom of the mold, it falls to the point where it discharges through the radial openings and rises as the pool of metal in the mold rises, being constantly in contact with the surface of the metal.

Q. In your description of figure 1 of the Hosack patent did you say that the metal upon entering the transfer ladle, A-small, from the furnace, B-small, first passes vertically through the transfer ladle? A. I would say that a portion of it does immediately and continues to fall while the ladle is being carried down by the accumulation of metal within the small ladle.

Q. The mold, C-small, in Hosack, is of considerable height. In view thereof would you say that any spattering would take place from the metal which passes through the bottom of the transfer ladle, A-small, striking the bottom of the bowl? A. I am positive that you would have splattering from such a ladle.

Q. Would there be any discharge from these lat-
42 eral openings in the ladle when the metal reached the lower portion of the mold? A. Yes, the metal under that ladle would build up to a point where there would be lateral discharges at the surface of the metal.

Q. Now, if the Hosack ladle and apparatus as shown in figure 1 were used in the case of copper, how would the resulting cake be affected thereby? A. Well, without doubt we would have the same splattering as existed in the direct pouring from the furnace ladle in vertical-cast cakes, and if the copper built up to the radial openings, we would have copper coming through against the side of the mold, which would solidify immediately, forming cold sets.

Q. Would there be any detriment to the casting operation as disclosed in Hosack when applied to iron or steel? A. No, because even though we have spattering of iron and steel at the high temperatures used, it is all redissolved or remelted before the completion of the casting and before the entire solidification. This method is primarily used to prevent oxidation.

Q. You stated that the construction of the Hosack patent figure 1 is a mechanical device and that the metal is tapped from the lower end of the furnace ladle or main ladle, B-small prime, and then lowered vertically into the mold.

Could such practice be followed in the casting of copper? A. No. In the first place, it has never been practical to cast copper from a large ladle through a dam opening,
43 and again, because of the low differential of temperature between the molten metal and its solidification point.

Therefore, with the present overflow type of furnace ladle that is used in copper casting, it naturally permits a curved trajectory into the mold, and a ladle of this type and of sufficient size to fit into the small mold would only go a short distance, before it would be out of the trajectory of the stream.

Q. Do you conceive of any way in which the mechanical means disclosed in figure 1 of the Hosack patent could be employed to follow that trajectory if the metal were poured from the side of the mold? A. No, I do not.

Q. I now ask you to describe briefly the remaining figures or modifications of the Hosack patent. A. In figure 2 it simply shows another method of suspension of a ladle within the mold cavity.

Figure 3 shows the ladle or a ladle with this modified suspension.

Figure 4 also discloses a modification of the method of suspension, using a single counterweight instead of a double counterweight.

Figure 5 shows a different type of ladle, in that it has a valve seat or stopper in the bottom of the ladle and also contains a second ladle within the first ladle.

In no case in this particular ladle is there any means of overflow. The metal coming from the bottom of the transfer ladle enters the inside ladle first, flows through the small openings in the bottom of the inside ladle, which is G-small—oh, no; I beg your pardon; that is incor-
44 rect; it flows through the openings in the bottom of the inside ladle and then into the outside ladle, which must fill up partially and contain sufficient weight to cause it to sink to the bottom of the mold.

When it reaches the bottom of the mold, the impact of the mold bottom on the pin, which is P-prime, opens the valve, P, and forces a section of the metal above the valve seat against the small ladle or inner ladle, thereby raising it, or preventing, rather, the valve from completely going out of the bottom of the ladle.

When this valve is open, the molten metal flows through the opening into the bottom of the mold, and as the metal rises in the mold, this ladle continues to rise in contact with the surface of the mold, and at the same time allows the metal to flow freely through the bottom.

Q. You stated that when the transfer ladle, A-small, reached the bottom of the mold, the valve, P, would open, due to the impact of the stem, P-small prime, at the bottom of the mold.

What would then happen to hold the valve in open position, so that the metal may flow out of the ladle? A. Well, it is apparent that that upper section of the valve becomes wedged in the section shown at Q, I guess it is—Q-small—

and is held there, permitting the free flow of metal through the bottom opening.

Q. Would you say that there is anything analogous in
the modification shown in figure 5 of the Hosack patent and
the ladle described as forming part of the invention
45 at bar? A. No, I don't believe there is anything
analogous.

Q. Do you recognize in figure 5 of the Hosack patent anything analogous to the discharge passage and shield around the discharge passage? A. There is nothing.

Q. Would you say that the ladle, figure 5, has an imperforate bottom, so as to collect a pool, while receiving the metal from the primary ladle before it is discharged into the mold? A. The outer section of the ladle has an imperforate bottom in that it has a valve sealing it until it reaches the bottom of the mold.

Q. After that, would the imperforations still remain? A. No, then the valve would open, and the discharge of metal is through the bottom of the ladle.

Q. In other words, discharge in figure 5 is through the bottom of the ladle in Hosack, whereas in the invention at bar the discharge is through a discharge passage disposed a substantial distance from the bottom and also a substantial distance below the top of the ladle bowl; is that right? A. That is correct.

Mr. Engel. I offer in evidence these enlarged photostatic drawings of the Hosack patent as Plaintiffs' Exhibits 8 and 9.

(Enlarged photostatic drawings of Hosack patent were marked as Plaintiffs' Exhibit 8 and 9 and received in evidence.)

By Mr. Engel:

Q. With respect to the patents to Chandler, En-
46 nor, and Hosack, which you have just described,
would you say that the ladles, that is, the casting
ladles, must be used throughout the entire period of casting? A. It is evident from the disclosure that they must be used throughout the entire period of casting.

Q. That is not necessarily so or desirable with the application or invention at bar, is it? A. That is not true of the invention at bar.

Q. I now show you a copy of a patent to Walker, No. 597,367, which has been introduced in evidence as Exhibit 1-A, and ask you whether you have considered the same and know the construction and operation thereof. A. I have read over this patent and understand the application disclosed.

Q. I now show you enlarged photostatic drawings of the drawings forming part of the said Walker patent and ask you to describe briefly the Walker invention. A. The Walker invention consists of a mechanically driven wheel for continuous casting of copper and comprises, first, a furnace ladle which pours into a distributor contained in a shallow mold or contained over a shallow mold.

Q. In your description of this patent, will you kindly make reference to either the colors or reference numerals of the parts? A. Well, the casting ladel is in brown on sheet 1 and also on sheet 2. This receives the copper from the melting and refining furnace and acts as a reservoir for the intermediate supply of copper.

47 This ladle is tilted by means of a mechanical device, and the copper then flows onto a distributor shown in green on sheet 1 and sheet 2 and is described by figure 7 on sheet 2.

From this distributor the copper then is divided in two directions into a shallow copper mold. In this particular case, as shown in sheet 2, the mold is a wire bar mold.

Now, this wheel may also be used for casting various other shapes of copper. In figure 27 is shown the flat cake molds. Figure 26 shows the small ingot bar mold. Figure 25 shows an ingot mold.

This portion of the patent discloses nothing that has reference to the type of casting for which the ladle under discussion is used.

Q. Would you say that in any of the types of shapes which are cast according to the Walker patent there is any substantial drop of the metal from the furnace or reservoir ladle to the mold. A. There is not.

Q. Approximately how great a drop would be present? A. At most, six inches.

Q. In figure 6 of this patent there are various forms of deflectors, so-called, by Walker, illustrated. Will you kindly describe the respective functions of those various deflectors? A. In figure 6 the deflector shown as 42 is simply a trough, open at both ends, and used to deflect the metal in two directions lengthwise of the mold. It was apparently primarily designed for the casting of wire bars. It shows no overflow. It is purely a deflecting device.

48 Figure 44 is a shallow ladle with a segment of a sphere, and from the indication of the drawing, very shallow. It is used in the casting of flat cakes, which permits the stream to fall into it and then discharge from the top surface in all directions. It really gives a flow in all directions equally.

In figure 45 we again have a receptacle or ladle or shallow ladle with two outlets, similar to an outlet that you would have on a cream pitcher, to concentrate the flow at the particular point, and, from the disclosure in the patent, it was used as a means of filling two ingot molds at the same time, and sat on the top of a partition between the two members of the mold and allowed the metal to flow in two directions, deflecting it in two directions.

Q. Would you say that the character of the lip, 46, as shown in figure 6 of the Walker patent, is of a character which might be said to be at all analogous to the discharge opening in the ladle under consideration? A. It is not.

Q. Would you say that there is anything in the said figure analogous to the shield portion of the ladle under consideration? A. There is not.

Q. Would you say that from the portions of the parts of the ladle bowl and lips in numerals 45 and 46 of the Walker patent, a ladle deflector of that character would be useful to catch any spattering of metal received in the ladle when it reached the height of the lip, 46? A. No, it would not.

49 Q. In other words, the ladle, 45, or the deflector, 45, of the Walker patent does not have a shield portion at all? A. No, no appreciable shield portion at all.

Mr. Engel. I introduce in evidence three sheets of drawings, the three enlarged photostatic drawings, corresponding to the drawings of the Walker patents, as Plaintiffs' Exhibits 10, 11, and 12.

(Three sheets of enlarged photostatic drawings of Walker patent were marked as Plaintiff's Exhibits 10, 11, and 12, and received in evidence.)

By Mr. Engel.

Q. Referring to the Walker patent, particularly figure 6 thereof, and the ladle shown at numeral 45, approximately what proportion of the total depth of the ladle would you consider the lip portion to be? A. I would say one to eight or one to nine.

Q. In the ladle or the invention at bar, how high is the shield portion; that is, the portion of the ladle above the discharge opening, with respect to the total depth of the ladle bowl? A. It is about one-third.

Q. Roughly speaking, with respect to Plaintiff's Exhibit 6, the ladle, about what is the height in inches of the shield portion, and what is the total depth of the bowl? A. Well, it is approximately an inside dimension of about four inches, and the depth of shield from the bottom of the outlet is between an inch and a quarter and an inch and a half. About an inch and a quarter, I would say from here.

Q. If a ladle similar to that shown in figure 6 of the Walker patent, having the lips, 46, thereon, were made having a depth corresponding to the depth of this ladle
50 which you have just described, what would be the
depth or the approximate depth in inches of the lip portion or the ring surrounding the lip portion? A. Oh, it would be a half inch or less.

Q. So, comparing the Walker deflector in question with the applicant's ladle under consideration, for ladles having corresponding depths of bowl, the height of the shield portion in the applicant's ladle will be about one and one-fourth to one and one-half inches, I believe you said? A. That is right.

Q. Whereas, in the Walker patent it would be one-half inch? A. One-half or less, from the drawing.

Q. In your opinion, would a shield of one-half inch serve any considerable useful purpose in preventing spattering? A. I don't believe it would.

The Court. We shall take a recess until one-thirty.

(Thereupon, at 12:30 o'clock p. m., a recess was taken until 1:30 o'clock p. m. of the same day.)

51 AFTER RECESS

The proceedings were resumed, pursuant to the recess, at 1:30 o'clock p. m.

The Court. Very well, gentlemen.

Thereupon **Daniel L. Ogden**, a witness previously called,

Thereupon Daniel L. Ogden, a witness previously called, sworn, and examined, resumed the stand and was further examined and testified as follows:

Further Direct Examination

By Mr. Engel:

Q. Referring back to the Walker patent, do you recall whether the specification makes any mention of a shielding portion for preventing spattering or the like? A. It does not.

Q. You definitely say it does not? A. It does not.

Q. Now considering the four patents which you have previously described, namely, the Chandler, Ennor, Hosack, and Walker patents, would you say that any of them has any mechanism for guiding or permitting the lowering along a curved trajectory of a stream, so that the stream of metal from a furnace ladle, or the spout thereof, can be permitted to form a pool in the ladle, and the ladle lowered to the bottom or near the bottom of the vertical mold, whereat the metal may discharge from the ladle? A. There is no disclosure in any of the patents.

Q. Again considering the patents set up in the rejection of the claims, did you make any endeavor to test
52 out the constructions disclosed in those patents, to
determine whether they are suitable for casting copper in vertical parallel-side deep molds such as those to which the present invention is directed? A. We did, but it was necessary to modify the disclosure in order to meet the conditions existing in the type mold used.

Q. In other words, if you sought to follow the teachings of the Hosack patent, what did you do? A. It was necessary to change the ladles from a portion of a sphere to an elongated ladle so that they would fit in the 4 inches or 5 inches allowed in the vertical cast mold.

Q. What did you do with respect to the mechanical means disclosed in the Hosack patent? A. We added to the ladle a handle, to permit it to be lowered in the mold by manual means.

Q. In other words, you sought to adapt the mechanical-type Hosack ladle to a manually operated ladle such as embodied in the present invention? A. That is correct.

Q. You say that you conducted various experiments to determine whether or not the references or the construction of the references could be used to carry out the invention: With respect to the Hosack patent, will you kindly explain what you have done with respect to certain of the models, from which you may choose, and describe them as you proceed? A. In the first case (indicating), we made a flat-sided ladle having a very small opening in the bot-
53 tom, approximately one-eighth of an inch, and hav-
ing four holes on the sides approximately one half inch. In pouring copper into this ladle, the moment the copper hit the bottom of the ladle, it froze in the small opening, and no copper seeped through. And as it built up, it flowed out from the four holes at the sides, and came in contact with the walls, forming cold sets. There was no opportunity in this ladle for unidirectional flow—that is, it came out from all four holes, as it filled up. And finally, after the copper had been cast, the skull remaining in the ladle could not be removed except by mechanical means. It could not be dumped out of the ladle at all.

Q. With respect to the model you have in your hand, which embodiment of the Hosack invention did you seek to duplicate? A. (Indicating on a drawing) This is an adaption of figure 1, which is shown as a round, cylindrical ladle with an opening in the bottom and transverse openings on the sides. If this had been adapted, as shown, it would—in a circular model—it would have been too small to do anything with. Hence the reason for elongating it into the shape shown in the model here.

Q. Viewing figure 1 of Hosack, would you say that the opening in the bottom of the ladle was equal to, larger than, or smaller than the side-wall openings? A. It would appear from the illustration shown that the bottom opening is as large or perhaps larger than the side openings.

Q. So that the model which you have just de-
54 scribed does not strictly follow the Hosack, in that
the opening in the bottom is smaller than the lateral openings in the ladle? A. That is right.

Mr. Engel. I introduce in evidence this model, just described, as Plaintiffs' Exhibit No. 13.

(Model from Hosack patent was marked Plaintiffs' Exhibit No. 13 and received in evidence.)

The Witness. Following this, they used the same type ladle but put an opening in the bottom, of the same size as the four transverse openings in the sides. In this case the copper was poured into the ladle, which ran through the bottom opening as fast as it was poured into the ladle, and before the ladle would be lowered and filled up to overflow, the spatter was obtained on the sides and bottom of the mold.

By Mr. Engel:

Q. So that this model, you would say, most closely approximates figure 1 of Hosack, as adapted for use in pouring in a deep, parallel-side mold? A. That is correct.

Mr. Engel. I introduce in evidence this model, as Plaintiffs' Exhibit No. 14.

(Second model from Hosack patent was marked Plaintiffs' Exhibit No. 14, and received in evidence.)

By Mr. Engel:

Q. I hand you another model which you claim to have tried out, and ask you to explain it. A. In this model we used the small openings—one-eighth-inch openings—
55 in the bottom and around the sides of the ladle. In this case there was no copper came through the openings whatever; it simply built up on the sides and overflowed in all directions at the top of the ladle, where there was nothing to guide it in any direction.

And you also note in this that it is impossible to remove the skull from the ladle without damaging the ladle itself.

Q. Why is it impossible to remove the skull? A. Because it has solidified in the openings and is riveted or welded in the openings of the ladle, and would have to be pried out or forced out in some way, or taken apart, and probably would damage the ladle in so doing.

Mr. Engel. I introduce the ladle just described, as Plaintiffs' Exhibit No. 15.

(Ladle with small openings in bottom and sides was marked Plaintiffs' Exhibit No. 15 and received in evidence.)

By Mr. Engel:

Q. Did you make any endeavor to construct and test a ladle corresponding to the valved type of ladle disclosed in the Hosack patent? A. We did.

Q. I show you this model (indicating) and ask you if this represents what you endeavored to do. A. Yes, this is the model that was tried out, and the valve was placed in the bottom, in manner similar to that shown in figure 5 of the Hosack patent. Copper, when poured into this, with the valve closed, as described in the Hosack patent, held the copper without any difficulty; but by the
56 time it had reached the bottom, it had started to
congeal, forced the bottom open, and it simply congealed over the bottom, and nothing came out at all, and simply came over the top, and out in all directions.

Q. In other words, the valve simply froze on its seat? A. That is right.

Q. I notice figure 5 of Hosack shows a ladle with what may be termed concentric bowls. Did you have a concentric bowl in the model which you have before you? A. No, this model was designed without the central bowl, but merely the outside valve in the bottom and a support in the center to control that valve.

Q. And you say that in this model, no copper was discharged except over the top? A. That is correct.

Q. And that the valve froze so that it could not possibly operate as figure 5 in Hosack? A. That is correct.

Mr. Engel. I introduce in evidence this model which has just been described, as Plaintiffs' Exhibit No. 16.

(Model with valve in bottom was marked Plaintiffs' Exhibit No. 16 and received in evidence.)

By Mr. Engel.

Q. Did you make any endeavor to test out the disclosure in the Ennor patent, to see whether it was at all applicable to the casting of copper? A. We did.

Q. I show you a model, or what purports to be a model, which you claim to have made of the Ennor construction, 57 and ask you to describe the same. A. This consists of a shallow bowl or ladle contained inside of a shield, the shield extending to the bottom of the—approximately to the bottom of the ladle, and supported by the handle and back and by a connection in front, to keep it rigid.

When the copper was poured in this, it started to overflow; and after a short period, it began to freeze between the ladle and the shield. And while copper passed through on one casting, by the time a second casting would have been made, it would have been entirely solid and would have become just an ordinary ladle with uniform top.

It was impossible, because of the shape of the ladle and the congealing of the copper between the ladle and the shield, to remove the skulls thus formed without virtually taking the whole business apart.

Q. The so-called shield in this model is not contiguous with the bowl, is it? A. It is not.

Q. And, as shown here, is merely attached thereto and encircling the same and providing a substantially annular space between the bowl and the shield? A. That is correct.

Q. I also note that the bowl is rather shallow. Would that have any effect upon the reception of the copper from the furnace ladle? A. Well, the shallow bowl would have a tendency to give considerable splashing. It would also fill up very rapidly and, with the small amount of
58 copper that it would contain, would cause the copper to overflow before you approached the bottom of the mold.

Q. This model was not used with the other teachings of the Ennor patent, namely, the feeding of the molten metal to the bowl by way of a siphon tube, was it? A. It was not. It was impossible to do it.

Q. That is to say, copper could not be siphoned? A. Copper could not be siphoned.

Mr. Engel. I introduce the model just described, of the Ennor type ladle, as Plaintiffs' Exhibit No. 17.

(Model of Ennor type ladle was marked Plaintiffs' Exhibit No. 17 and received in evidence.)

By Mr. Engel:

Q. Did you make any endeavor to test out the operativeness of the Chandler device, with respect to the pouring of copper? A. No, we did not use the Chandler device or make an effort to use it, because of the fact that a mold such as that is, with one wall taken away from the mold and a belt of sheet metal substituted, would prove—it would prove unsatisfactory with copper, because the copper would seep between the face of the mold and the separate side, causing fins, and stick between the mold and the separate side, and would prevent operating the mold.

Q. In other words, in your opinion the disclosure in the Chandler patent is wholly inoperative for casting copper? A. It is, absolutely.

Q. With respect to the Walker patent, did you make any
endeavors to follow out, or make any endeavors to
59 apply, its teachings to the casting of copper in deep
vertical molds having parallel sides? A. We did,
after looking over the various devices depicted in the Walker patent. The only one that was similar, or could be classed as similar, to what we were endeavoring to do was too large, as disclosed, to enter into a mold, and we therefore reduced it in size to fit the mold. And when reduced in size to enter the mold, it was entirely too small to be operative.

Q. I hand you a model which you claim to have made as representing an embodiment of the Walker patent, as disclosed in figure 6, with a deflector designated 45, and having lips 46 thereon, and I shall ask you to state specifically why that model was unsuitable for casting copper in deep molds. A. Well, in the first place, it would be entirely too small: The instant the stream from the furnace ladle would hit this, it would overflow before reaching the bottom of the mold; there would be no bath in this ladle to act as a shock absorber for the fall of the stream of metal. And if it were that a small enough stream could be used, it would overflow from the sides, because of the smallness of the so-called lips on this ladle.

Q. Was the bowl on this ladle made in strict proportion to the showing of the patent? A. It was.

Q. And you could not have made it any larger and used it, within a vertical mold having parallel sides? A. That is correct.

Mr. Engel. I introduce in evidence this model of
60 the Walker ladle, as Plaintiffs' Exhibit No. 18.

(Model of Walker ladle was marked Plaintiffs' Exhibit No. 18 and received in evidence.)

Mr. Engel. At this time, if your Honor please, I wish to introduce these enlarged photostat prints of the Ennor and Chandler patents, which were inadvertently omitted being introduced before, as Plaintiffs' Exhibits 19 and 20.

(Photostat print of Ennor patent was marked Plaintiffs' Exhibit No. 19 and received in evidence.)

(Second photostat print of Chandler patent was marked Plaintiffs' Exhibit No. 20 and received in evidence.)

Mr. Engel. At this time I should like to ask your Honor whether the Court would desire to see the moving picture shown again. If not, I should like to offer in evidence the roll of film, which was disclosed prior to adjournment.

The Court. The Court would not care to see that again, thank you.

Mr. Engel. Well, I accordingly offer in evidence, when it will be removed from the camera, that film, as Plaintiffs' Exhibit No. 21.

(Roll of motion picture film, previously projected, was to be marked Plaintiffs' Exhibit No. 21 and received in evidence.)

By Mr. Engel:

Q. Mr. Ogden, you have discussed these various patents, particularly the patents to Hosack and to Chandler and to Ennor, all of which employed mechanical means for casting metals other than copper. The question is, Do you consider that the casting of copper in deep vertical
61 molds can be successfully done by machine—such, for example, as disclosed in any of the patents enumerated? A. It is my opinion that it could not.

Q. Inasmuch as you do not believe that mechanical means can be employed for casting copper in deep vertical molds having parallel sides, will you kindly state what you think are the essential features of the invention at bar? A. First, a stream leaving the furnace or casting ladle, having a curved trajectory of such width that it will not touch the sides of the molds at any point within the cavity of the mold; and, second, a ladle that will be inserted below the lip of the furnace ladle, a sufficient size to carry a pool of metal that will prevent any appreciable splashing, the ladle to be of sufficient size that the pool will fill continuously as the ladle is lowered along the trajectory of the stream and will only begin to overflow over the lip of the ladle when it is in a position at the bottom of the mold, at such a height from the bottom of the mold that no splashing can occur.

Q. Do you also consider as an essential necessity of the invention, the fact that that ladle must have a shield? A. Well, there is always a certain amount of splash can occur when the molten metal is falling into a pool of metal, and it is essential that some means be taken to prevent this splash from getting on the sides of the mold. Hence, the shield is a necessity.

Q. Will you also state that a handle attached to the bowl is a necessity to carrying out the invention? A. I believe
that it is, so that the operator can handle the ladle
62 to the bottom of the mold, along the trajectory of
the stream.

Q. Must any degree of care be exercised in the manipulation of the ladle, in the casting operation? A. The operator must hold the ladle under the pouring spout of the furnace ladle, receive the copper therein, and gradually lower it as the ladle fills with copper, until the bottom of the mold cavity of the ladle is full and begins to overflow.

Q. Have you, in your experience in metallurgy, prior to the invention here under consideration, ever known any metal to be cast in the manner disclosed by the present invention? A. I do not.

Mr. Engel. Is there any cross-examination?

Mr. Whitehead. Only a few questions.

Cross Examination

By Mr. Whitehead:

Q. Mr. Ogden, with respect to the Hosack patent, No. 1,375,589, it is a fact, is it not, that the patent states that one of the objects of the invention is to diminish or obviate splashing? Isn't that stated in the specification of the patent? A. I believe it is.

Q. I see it is stated in the second paragraph there.

Is it also a fact that the appliance that he stated, may or may not put a stopple in the opening of the bottom of this pilot ladle; isn't that stated here?

63 A. I don't remember. May I have a copy of the patent?

(A document was handed to the witness, and examined by him.)

The Court. I have read it, and it does state.

By Mr. Whitehead:

Q. I refer you to page 2, the second column, near the bottom of the first paragraph, saying, "This ladle *a*". It is about line 80 of the second column on the second page. A. The second column?

Q. The second column of the second page. The sentence begins with the words, "This ladle *a*".

(The document was further examined by the witness.)

The Witness. What line is that?

By Mr. Whitehead:

Q. Line 80 of the second column. A. Line 80: Oh, yes, I have it. Yes, I see.

Q. Now, if you will look on the second column of page 1 of the patent, beginning line 75, it is stated in the patent that the pilot ladle may be moved by hand, is it not? A. Yes; it may be manually controlled.

Q. Isn't it a fact that in order to prevent the overflowing of the ladle, you have got to have a ladle of a certain size, as compared with the amount of copper that is being poured in, and moved at a certain, particular speed? A. That is true; yes.

Q. And it has to be big enough and moved fast enough for the copper not to overflow before it gets into the bottom of the mold? A. That is true.

64 Mr. Whitehead. That is all.

By the Court:

Q. In the Walker patent, is it not stated expressly that it is for the purpose of casting copper? It is specially mentioned there? A. That is right; the patent to Walker deals with copper only.

Q. I would not say it deals with copper only, but it specially mentions copper; isn't that right? A. That is right.

Q. Also, does not the Walker patent, page 2, line 85, say, "by the provision of these deflectors and the peculiar construction and manner of hanging the ladle all liability of the flowing metal to cold-set or core, splash, or cling is obviated and the casting of a solid cake, bar, or ingot insured."

He had in mind the trouble about splashing, didn't he? A. That is correct.

Q. Isn't the idea of a ladle, to break the fall of the falling liquid, what every cook uses when, instead of putting a pie plate, when she wants to get a little water from the spigot in the sink, which would splash all over, she lets the water, coming from the faucet with force, pour into a cup, and then pours that into the pie plate? That is the idea, is it not? A. That is the idea—to break the force.

Q. Yes, to break the force of the liquid, when coming out? A. Yes.

65 Q. And this patent in this case is operated by an individual who holds the ladle right where the molten copper is being poured out, and he must keep it right under there? A. He must; he must keep it under there.

Q. Yes; and he just draws it down, and must keep it where it is flowing out? A. That is correct.

Q. And he lowers it quickly, and it must keep pouring out, either by the overflow or where the holes on the sides are; is that correct? A. That is correct.

The Court. That is all.

(The witness left the stand.)

66 Endorsed: Filed Apr 28 1939

Plaintiffs' Ex. 1

Department of Commerce

United States Patent Office

To all persons to whom these presents shall come, Greeting:

THIS IS TO CERTIFY that the annexed is a true copy from the records of this office of the Petition, Specification, Oath and Drawing, as originally filed, in the matter of the Pending Application of William F. Eppensteiner and Albert Hillyer, Filed August 21, 1934, Serial Number 740,766, for Improvement in Methods and Apparatus for Casting Copper.

IN TESTIMONY WHEREOF I have hereunto set my hand and caused the seal of the Patent Office to be affixed, at the City of Washington, this twenty-seventh day of April, in the year of our Lord one thousand nine hundred and thirty-nine and of the Independence of the United States of America the one hundred and sixty-third.

CONWAY P. COE
(Seal) *Commissioner of Patents.*

Attest:

D E WILSON
Chief of Division.

67 Endorsed: Mail Division Aug 21 34 U. S. Patent Office

Endorsed: U. S. Patent Office Aug 28 1934 Division 3
(12876) HJC

Application for United States Letters Patent

Petition

With Power of Attorney

To the Commissioner of Patents,
United States of America:

Your Petitioners, William F. Eppensteiner and Albert Hillyer, both citizens of the United States of America, the former residing at Rahway, County of Union, and State of New Jersey, and the latter residing in Old Bridge, County of Middlesex, and State of New Jersey, and whose post office address is care of United State Metals Refining Company, Carteret, New Jersey, pray that Letters Patent of the United States be granted to them for the Improvements in Methods and Apparatus for Casting Copper, set forth in the annexed specification;

And they hereby appoint FRASER, MYERS & MANLEY (the said firm comprising, Eugene V. Myers, Franklin

G. Manley and Louis E. Giles as its members) of New York, N. Y., their Attorneys, with full power of substitution and revocation, to prosecute this application, to make alterations and amendments therein, to sign their names to the drawings, to receive the Letters Patent when issued, and to transact all business in the Patent Office connected therewith.

Signed at Carteret, New Jersey, this 14th day of August 1934

Signature of (each) Inventor

WILLIAM F. EPPENSTEINER,
ALBERT HILLYER.

68 *Specification.*

To all whom it may concern:

Be it known that we, William F. Eppensteiner and Albert Hillyer, both citizens of the United States of America, the former residing in Rahway, in the County of Union and State of New Jersey, and the latter residing in Old Bridge, in the County of Middlesex and State of New Jersey, have invented certain new and useful improvements in

Methods and Apparatus for Casting Copper, of which the following is a specification:

This invention relates to the casting of copper or similar metals or alloys.

When such metals are cast in molds of copper or similar metals, which molds are usually cooled by circulation of water, difficulty is experienced by reason of the pitting or erosion of the mold bottom by impact from the stream of molten metal falling through the height of the mold cavity; and by reason of the spattering or rebounding of the molten metal from the mold bottom and striking against the sides of the mold. The result is the roughening of the bottom plate or door by the forming of pits or indentations therein. On such interior of the mold surfaces there results such adherence between the casting and the mold as creates difficulty in dumping out the casting and also the surface of the casting is impaired by formation of rough or irregular portions and by so-called "cold sets".

These difficulties are somewhat avoided in the use of shallow horizontal molds in trough shape by the introduc-

tion into the mold of a shallow ladle which is placed under the spout and receives the stream of copper and from which the copper overflows gently into the mold. Of recent years the casting in such horizontal molds has been largely superseded by the use of vertical molds, and with
these the distance through which the stream of cop-
69 per falls is so much greater that the use of such ladle
becomes ineffective because there is a spattering or
rebound from the ladle itself or the pool of metal initially accumulating therein which is nearly as damaging as if no ladle were used.

The present invention provides an improved method of casting copper or analogous metal in vertical molds or molds having considerable height, and especially in those where the casting cavity is narrow, being confined between closely adjacent side walls. According to this invention a special ladle is provided having a handle projecting upward from it to a height greater than that of the mold, so that the handle projecting above the mold may be conveniently grasped by the foundryman. At the beginning of the pouring the ladle is held up close beneath the spout from which the metal is poured and until an initial pool of metal is formed within the ladle, whereupon the ladle is lowered by the workman into the mold following the line of trajectory of the stream of molten metal, so that before any overflow from the ladle occurs it has been lowered to the bottom or near the bottom of the mold; the molten metal flowing into the ladle then outflows therefrom through a discharge opening or lip from which the stream falls only a short distance or under low head to the bottom of the mold, so that it has no material impact and no abrasive effect. The ladle is kept at the bottom of the mold until the copper overflowing therefrom fills the lower part of the mold around the ladle, whereupon the ladle is elevated, either by floating up with the rising level of molten metal or by being elevated slightly above it by the operator; whereby the impact of the stream of molten metal is broken by being received into the pool formed within the ladle. The
ladle is kept in the mold preferably until the latter is
70 filled approximately one-fourth of its capacity, or
at least one-sixth or one-fifth thereof, and at any
convenient time thereafter the operator lifts the ladle out

of the mold, pouring out from it in doing so the molten copper remaining therein.

Following this method the spattering or rebound of the molten copper on first entering the mold is effectually prevented and the pitting or other roughening of both the mold bottom and side surfaces of the mold cavity is avoided.

In practicing the invention it is preferable to provide a ladle sufficiently narrow to freely fit within the mold and having one or more discharge openings, preferably at a level intermediate the bottom and top of the ladle.

The accompanying drawings illustrate the practice of the invention and show the preferred constructions of the ladle as related to the mold.

Figure 1 is a vertical section of the mold, pouring spout, and ladle during the casting operation, the ladle being shown in three successive positions;

Fig. 2 is a horizontal section of the mold, showing the ladle in plan;

Fig. 3 is a side view, and Fig. 4 an edge elevation of the ladle on a larger scale;

Fig. 5 is a side view, and Fig. 6 a vertical transverse section of a modified form of ladle;

Figs. 7 and 8 are a side elevation and plan of a further variation in the form of ladle;

Fig. 9 is a side elevation, and Fig. 10 a plan of a cylindrical form of the ladle.

71 In the drawings A shows the mold and B the dropped bottom thereof. Such molds are commonly formed or bored with passages for the flow of the cooling water, this detail not being shown in the drawings. C is the ladle which in Fig. 1 is shown in three positions, 1, 2 and 3, Nos. 1 and 3 being shown in dotted lines. The ladle consists of a receptacle of suitable shape for convenient entry within the mold, its shape being determined by the dimensions and proportions of the mold cavity. The ladle has a handle D of such height that it projects far enough above the top of the mold to be grasped and manipulated by the operator. To provide a supplemental handle for lifting the ladle and to keep the handle from resting against the the top of the mold, it is desirably provided with a lug E projecting rearwardly and contacting with the mold wall,

thereby forming a guide for assisting the operator in correctly locating the ladle within the deep mold cavity. The molten metal when poured falls in a jet or stream 4, and the operator in lowering the ladle from its initial position, carries it down in a path coincident with the stream so that the molten copper falls within the ladle during its descent. The ladle is held in its initial position until at least a shallow pool of accumulating molten metal is formed therein and is then lowered to position 2 at the bottom of the mold before any material outflow of molten copper can occur from the ladle. For providing for such outflow an outlet opening F is formed in the mold, or there may be two opposite openings, the latter being shown in Figs. 7 to 10. The pouring spout is shown in Fig. 1 at G. The portions of the ladle above these openings serve as a shield and catch and prevent splashings or rebound of molten metal from hitting the side walls of the mold.

72 The dimensions of the ladle viewed in plan are dictated by the internal outline of the mold cavity. The ladle shown in Figs. 3 and 4 is adapted for a narrow mold for casting plates or cakes, as shown in Fig. 2. Figs. 7 and 8 show a ladle in the shape of a deep bucket of nearly square contour in plan and having opposite outflow openings F, F.

The ladle shown in Figs. 9 and 10 is cylindrical and is adapted for the casting of cylindrical ingots, the mold cavity of which is slightly greater than the diameter of the cylindrical ladle.

In any case the outflow opening or openings F should be at a level intermediate between the bottom and top of the ladle and not far from midway thereof, as shown. In the ladle shown in Fig. 5 the outflow opening F′ has a lip or spout formed by cutting down the wall of the ladle on its outflow side, and in this case it is shown as being at a level slightly above the middle.

The method of operating and the advantages thereof have been hereinbefore fully set forth.

While we have shown and described one form of our invention, it will be understood that we do not wish to be limited thereto, since numerous and varied changes may be made therein without departing from the spirit of the invention.

73 What we claim is:

1. The method of casting copper or similar metal in vertical molds to prevent pitting the mold, and cold sets in the casting, which consists in pouring the metal initially into a ladle adjacent the pouring spout to form a pool of metal therein, and lowering the ladle into the mold during the pouring, whereby the stream of metal is received into the ladle and flows thence at low elevation into the mold.

2. The method of claim 1, followed by the ladle being elevated with the accumulating of molten metal within the mold, and finally lifting out the ladle.

3. The method of claim 1, the ladle used having an outlet opening at a level intermediate its bottom and top, so that a pool below said level first forms in the ladle, the lowering of the ladle being performed while said pool is forming and before any material overflow from said opening occurs.

4. The method of claims 1 and 2, the ladle being lifted from the mold when the latter is about one-fourth filled with metal.

5. The method of claims 1, 2 and 3, the ladle being kept at the bottom of the mold until the overflow from the outlet opening of the ladle occurs, and the mold is filled as high as the top of the ladle and the ladle thereafter lifted from the mold.

6. A ladle for casting copper or similar metal in vertical molds having a bowl, an opening in said bowl, and a shield portion extending above said opening.

74 7. A ladle for casting copper or similar metal in vertical molds having a bowl and an opening through said bowl sufficiently above its bottom to permit the formation of a pool of metal therein, and the sides of said bowl being extended above said opening.

8. The ladle of claim 6, having a handle extending generally in an upward direction from said bowl.

9. The ladle of claim 7, having a handle extending generally in an upward direction from said bowl.

10. A ladle for casting copper or similar metal in vertical molds having a bowl, a handle extending generally upward from said bowl, and a supplemental handle arranged between the bowl and the upper part of the first handle.

75 In Witness whereof, we have hereunto signed our name.

WILLIAM F. EPPENSTEINER.
ALBERT HILLYER

Oath

STATE OF NEW JERSEY,
County of Middlesex, ss:

William F. Eppensteiner and Albert Hillyer, the abovenamed petitioners, being duly sworn, depose and say, that they are citizens of the United States of America, and residents of the State of New Jersey, the former residing in Rahway, County of Union, and the latter residing in Old Bridge, County of Middlesex, that they verily believe themselves to be the original, first and joint inventors of the Improvements in Methods and Apparatus for casting Copper, described and claimed in the foregoing specification; that they do not know and do not believe that the said invention was ever known or used before their invention or discovery thereof, or was patented or described in any printed publication in any country before their invention or discovery thereof, or more than two years prior to this application, or was patented in any country foreign to the United States of America, on an application filed by them or their legal representatives or assigns more than twelve months before this application, or was in public use or on sale in the United States of America for more than two years prior to this application; and that no application for patent for said invention has been filed by them or their legal representatives or assigns in any country foreign to the United States of America.

WILLIAM F. EPPENSTEINER.
ALBERT HILLYER

Sworn to and subscribed before me this 14th day of August 1934.

SUMNER MOORE
(Seal) *Notary Public of New Jersey*

My Commission expires Jan 27, 1935.

Fig.1.

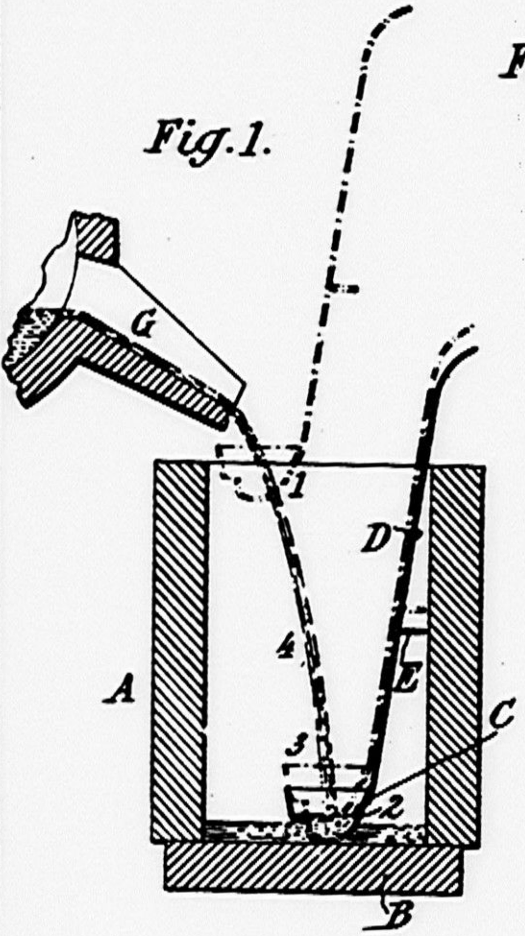


Fig.4

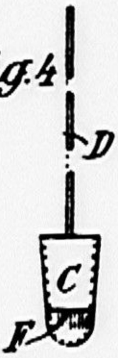


Fig.3.

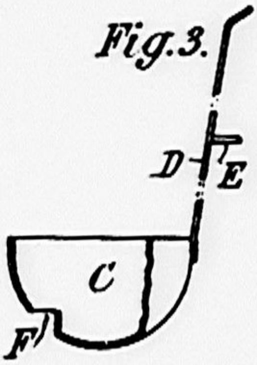


Fig.7.

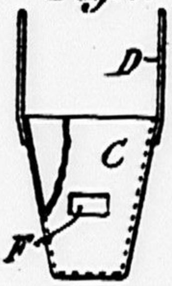


Fig.8.

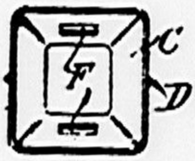


Fig.9.

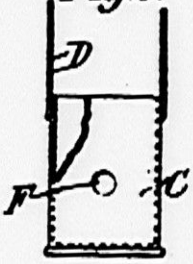


Fig.10.

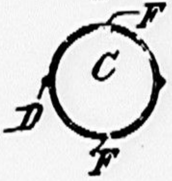


Fig.2.

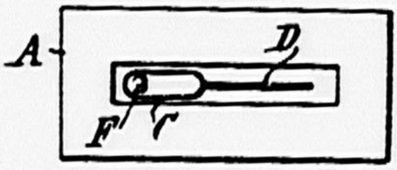
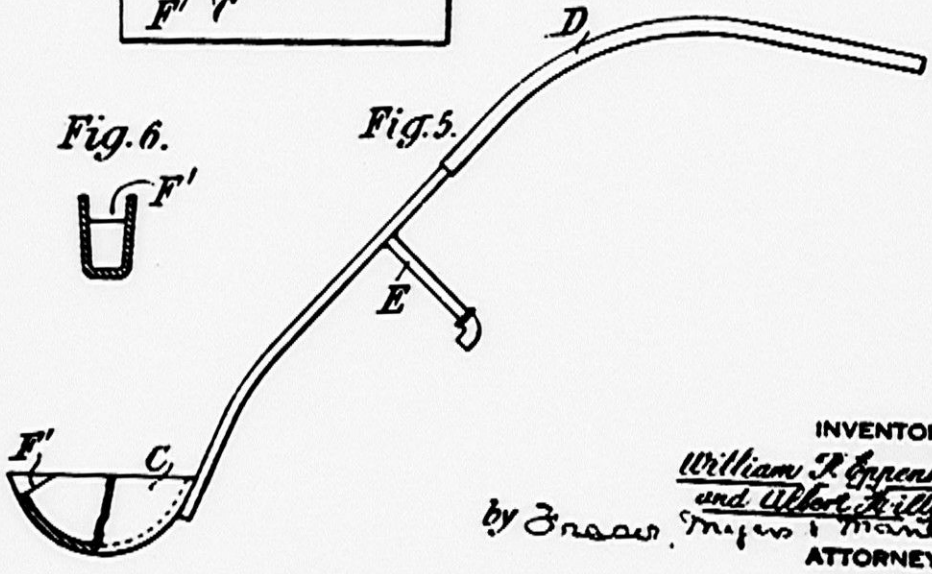


Fig.6.

Fig.5.



INVENTORS:

William F. Eppensteiner
and Albert Hillyer,
by Fraser, Myers & Manley
ATTORNEYS.

77 Endorsed: Filed Apr 28 1939

Plaintiffs' Ex. 2

Department of Commerce
United States Patent Office

To all persons to whom these presents shall come, Greeting:

This is to Certify that the annexed is a true copy from the records of this office of Appeal to the Board of Appeals, filed April 14, 1936, in the matter of the Pending Application of William F. Eppensteiner and Albert Hillyer, Filed August 21, 1934, Serial Number 740,766, for Improvement in Methods and Apparatus for Casting Copper.

In Testimony Whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed, at the City of Washington, this twenty-seventh day of April, in the year of our Lord one thousand nine hundred and thirty-nine and of the Independence of the United States of America the one hundred and sixty-third.

CONWAY P. COE
(Seal) *Commissioner of Patents.*

Attest:
D. E. WILSON
Chief of Division.

78 Endorsed: Mail Division Apr 14 1936 U. S. Patent Office

Endorsed: Apr 14-36 190874 B-Check—#9 15.00

Endorsed: Board of Appeals Apr 15 1936 U. S. Patent Office

Endorsed: U. S. Patent Office Apr 17 1936 Division 3

(12876) M/KG

In the United States Patent Office

Div. 3, Room No. 4093,
Application No. 740,766,
Filed August 21, 1934.

Applicants: William F. Eppensteiner and Albert Hillyer,
Invention: Methods and Apparatus for Casting Copper,

Appeal to the Board of Appeals.

Hon. Commissioner of Patents,
Washington, D. C.

Sir:

The above-named applicants hereby appeal to the Board of Appeals from the action of the Examiner dated October 21, 1935, finally rejecting *claims 11, 12, 13, 14, 16, 17 and 18.*

The reasons for appeal are as follows:—

1. The Examiner erred in rejecting the claims upon the references and for the reasons of record;

2. The Examiner erred in rejecting the claims as unpatentable in view of the prior patents to *Hosack, Ennor, Chandler*, and *Walker*.

An oral hearing is requested.

The appeal fee of Fifteen Dollars ($15.00) is sent herewith.

Respectfully,

WILLIAM F. EPPENSTEINER and
ALBERT HILLYER,

By their Attorneys,

FRASER, MYERS & MANLEY

Dated: New York, N. Y.,
April 11, 1936.

79 Endorsed: Filed Apr 28 1939

Plaintiffs' Ex. 3

Department of Commerce

United States Patent Office

To all persons to whom these presents shall come, Greeting:

This is to Certify that the annexed is a true copy from the records of this office of Examiner's Statement, dated May 1, 1936, in the matter of the Pending Application of William F. Eppensteiner and Albert Hillyer, Filed August 21, 1934, Serial Number 740,766, for Improvement in Methods and Apparatus for Casting Copper.

In Testimony Whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed, at the City of Washington, this twenty-seventh day of April, in the year of our Lord one thousand nine hundred and thirty-nine and of the Independence of the United States of America the one hundred and sixty-third.

CONWAY P. COE
Commissioner of Patents.

(Seal)

Attest:

D. E. WILSON
Chief of Division.

80 Endorsed: Mailed May 1-1936

S-3:G

No. 10

United States Patent Office.

Before the Board of Appeals.

In re application of Wm. F. Eppensteiner and Albert Hillyer, Serial No. 740,766 Filed Aug. 21, 1934. For: Methods and Apparatus for Casting Copper

Examiner's Statement.

This is an appeal from the final rejection of claims 11, 12, 13, 14, 16, 17 and 18. At the time that applicants filed their appeal, they filed an amendment cancelling claims 11 to 14, inclusive, and rewriting them as claims 19 to 22, inclusive, so that the claims now under consideration are claims 16 to 22, inclusive. Claim 15 stands allowed. The claims under consideration read as follows:

16. The method of casting copper or similar metal in vertical molds to prevent pitting the mold and cold sets in the casting, which consists in pouring the metal in a curved path toward the interior of the mold, catching the metal thus poured in a ladle before the metal strikes the interior of the mold and moving the ladle in a path downwardly into the mold to a point near the bottom thereof before the main stream of metal overflows the ladle.

17. In the method of claim 16, the step of preserving a pool of metal in the ladle well below the top thereof and permitting the exit of the metal at a point well below the top thereof when the ladle is near the bottom of the mold cavity.

81 *18.* In the method of claim 16, the step of moving the ladle upwardly along the curved path of the poured metal as the level of the metal in the mold increases.

19. A ladle for casting copper or similar metal in vertical molds, said ladle having a bowl open at its top to receive a stream of molten metal from the pouring device and provided with an imperforate bottom portion to contain a pool of metal as it is poured, and said bowl having an opening above said imperforate bottom portion through which opening metal flows to the interior of the mold, and said ladle having a shield portion extending well above said opening and leading into said bowl and adapted to substantially prevent splashing of metal out of said bowl into the interior of the mold.

20. A ladle for casting copper or similar metal in vertical molds, said ladle having a bowl open at its top to receive a stream of molten metal from the pouring device and provided with an imperforate bottom portion to contain a pool of metal as it is poured, and said bowl having an opening above said imperforate bottom portion through which opening metal flows to the interior of the mold, and said ladle having a shield portion extending well above said opening and leading into said bowl and adapted to substantially prevent splashing of metal out of said bowl into the interior of the mold, and said shield portion extending around the top of the ladle and over said opening.

21. The ladle of claim 19 having a handle fixed firmly to the bowl of the ladle and extending generally in an upward direction from said bowl.

22. The ladle of claim 19 having a handle fixed firmly to the bowl of the ladle and extending generally in an upward direction from said bowl, and a supplemental handle in fixed relation to the first and extending angularly from the same.

The art relied upon in rejecting the claims is as follows:

Walker	597,367	Jan. 11, 1898	22/63
Hosack	1,375,589	Apr. 19, 1921	22/79
Ennor et al.	1,983,579	Dec. 11, 1934	22/79
Chandler	1,983,578	Dec. 11, 1934	22/209

82 The alleged invention described and claimed consists of a method of pouring molten copper into a mold and a ladle for use in carrying out the method. The method consists of intercepting a stream of copper flowing from a pouring spout with a ladle and then lowering the ladle along said stream to the bottom of the mold. Applicants assert that this procedure gets the stream to the bottom of the mold without producing splashing. The ladle is designed to allow the copper to flow out of it before it is completely filled.

Claims 16, 17 and 18 were rejected as unpatentable over Hosack. These claims are directed to the method. Claim 16 differs from the method disclosed by Hosack solely by the words "in a curved path"; that is, Hosack discloses the method in connection with the spout of a bottom-pour ladle, which normally delivers a straight stream, whereas applicants use the spout of a top-pour ladle or crucible, which normally produces a curved stream. It is obvious that the essence of the Hosack method is that the ladle must follow the path of the stream, so that the metal will be intercepted by the ladle before it reaches the mold. If the ladle is to be filled by a spout producing a curved stream instead of a straight one, it is obvious that if Hosack's method is to be used, the ladle must follow a curved path instead of a straight one. Claim 17 depends on claim 16 and adds to it by the fiction of the steps of "preserving" and "permitting" the structure of the structure of the ladle used. Incidentally, Hosack discloses this structure in Fig. 5.

83 Claim 18 depends on claim 16 and adds to it the step of raising the ladle as the metal rises in the mold, an idea that is clearly disclosed by Hosack. If the metal is flowing into the mold in a curved stream, it is obvious that the ladle must be raised in a curved path if it is to continuously intercept the stream.

Claims 19 and 20 replace claims 11 and 12, which were rejected as unpatentable over any one of Hosack, Ennor et al. and Chandler. Hosack's ladle *a*, as clearly appears from Fig. 1, has an opening (five are shown) above the bottom through which metal may flow into the mold. When the bottom opening of Hosack's ladle *a* is closed by stopper (as Hosack suggests in Fig. 5), his bottom is in effect imperforate. Hosack's ladle extends well above the side openings shown in Fig. 1, and this extension constitutes a shield portion. Ennor et al. disclose in Figs. 1, 2 and 5 a device 5, which is the equivalent of the ladle claimed, because it performs the same function in substantially the same manner. The fact that the shield portion is not directly connected to the bowl portion is immaterial for it merely amounts to extending the opening F of the device shown by applicants in Figs. 1, 2 and 3. The comparatively narrow ribs 9 do not close the top of the bowl and obviously could be cut away in part if another method of suspension were to be used. Chandler discloses a reservoir 3, which is the equivalent of applicants' ladle, and a baffle plate 4, which performs the same function as would be performed by extending the end of reservoir 3 upwardly.

84 Claims 21 and 22 replace claims 13 and 14, which were rejected as lacking invention over any one of Hosack, Ennor et al. and Chandler in view of Walker. Claims 21 and 22 depend on claim 19 and add to it a handle fixed to the ladle. Walker discloses mounting on a handle a device for intercepting a stream of metal flowing into a mold to prevent it from splashing. In view of this disclosure no invention would be involved in mounting the device of any one of Hosack, Ennor et al. and Chandler on a handle similar to Walker's, for no new and unobvious results are produced. Claim 21 reads squarely on Walker's handle. Claim 22 brings in the handle structure, for which claim 15 was allowed. However, there is no reason for applicants to have claim 22 in addition to claim 15.

Respectfully,

A LINDSEY
Examiner, Div. 3.

85 Endorsed: Filed Apr 28 1939

Plaintiffs' Ex. 4

Department of Commerce

United States Patent Office

To all persons to whom these presents shall come, Greeting:

This is to Certify that the annexed is a true copy from the records of this office of Decision by the Board of Appeals, dated January 19, 1937, in the matter of the Pending Application of William F. Eppensteiner and Albert Hillyer, Filed August 21, 1934, Serial Number 740,766, for Improvement in Methods and Apparatus for Casting Copper.

In Testimony Whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed, at the City of Washington, this twenty-seventh day of April, in the year of our Lord one thousand nine hundred and thirty-nine and of the Independence of the United States of America the one hundred and sixty-third.

CONWAY P. COE
(Seal.) *Commissioner of Patents.*

Attest:

D. E. WILSON
Chief of Division.

86 Endorsed: U. S. Patent Office Board of Appeals Jan 19 1937 Mailed

Endorsed: Appeal No. 18,613 Paper No. 14 Decision.

Appeal No. 18,613 VFM

Hearing:

January 6, 1937

In the United States Patent Office

Before the Board of Appeals

Ex parte William F. Eppensteiner and Albert Hillyer

Application for Patent filed August 21, 1934, Serial No. 740,766. Methods and Apparatus for Casting Copper.

Messrs. Fraser, Myers & Manley for applicants.

This is an appeal from the final rejection of claims 16 to 22, inclusive.

Claims 16 and 19 are illustrative.

16. The method of casting copper or similar metal in vertical molds to prevent pitting the mold and cold sets in the casting, which consists in pouring the metal in a curved path toward the interior of the mold, catching the metal thus poured in a ladle before the metal strikes the interior of the mold and moving the ladle in a path downwardly into the mold to a point near the bottom thereof before the main stream of metal overflows the ladle.

19. A ladle for casting copper or similar metal in vertical molds, said ladle having a bowl open at its top to receive a stream of molten metal from the pouring device and provided with an imperforate bottom portion to contain a pool of metal as it is poured, and said bowl having an opening above said imperforate bottom portion through which opening metal flows to the interior of the mold, and said ladle having a shield portion extending well above said opening and leading into said bowl and adapted to substantially prevent splashing of metal out of said bowl into the interior of the mold.

87 The references relied upon by the examiner are as follows:

Walker	597,367	Jan. 11, 1898
Hosack	1,375,589	Apr. 19, 1921
Chandler	1,983,578	Dec. 11, 1934
Ennor et al	1,983,579	Dec. 11, 1934

The subject of the appealed claims relates to method and apparatus for casting copper. Applicants disclose casting of copper in a relative tall thin parallel rigid walled ingot mold and point out that if a stream of molten copper is simply directed into such mold that it splashes badly at the beginning of the pour. A ladle-like device is accordingly provided which ladle comprises such details as set forth in claim 19. It is actuated in accordance with the steps set forth in the method claim 16.

The prior art discloses that applicants are not the first to appreciate that it is desirable to diminish or obviate splashing of metal when poured into ingot molds. The patent to Hosack clearly sets forth this object and discloses a method and an apparatus for accomplishing it. Hosack provides a small ladle-like device designated a pilot ladle which catches and accumulates the front end of the stream of molten metal as it begins to pour into the mold and as in applicants' method, the small pilot ladle is allowed to descend immediately to the bottom of the mold. Hosack's pilot ladle has openings in the side like applicants' ladle and in addition has an opening in the bottom in the species of Fig. 1. Hosack shows several species and in that of Fig. 5 the pilot ladle is in effect closed at the bottom until it descends and the valve pin *p′* opens the valve *p*, or as in Fig. 4, the
pilot ladle may be provided with a manually actuated
88 valve to be opened when the pilot ladle descends to
the bottom of the ingot mold. Hosack's pilot ladle of
Figs. 4 and 5 has no openings in the side.

After careful consideration, it is our view that claims 15, 16, 17 and 18 directed to the method present no patentable merits over Hosack. The principle of action and result accomplished by Hosack is regarded as fully equivalent if not identical in all respects and details to applicants'. We agree with the examiner's conclusions that if the stream of metal be poured from a side position of the source in a curved path, it would be obvious to cause Hosack's pilot ladle to follow such curved path rather than move in a straight path where the metal is discharged in a vertical and straight line. This would appear to be only ordinary mechanical sense or skill.

As to the point of whether the pilot ladle is opened directly in the bottom by a small opening or closed as seems to be implied in claim 17, preserving a pool of metal in the ladle and permitting exit of metal at a point below its top only, we think Hosack preserves a pool of metal at the top even though some of the metal may be escaping also through the hole in the bottom. However, since Hosack discloses two species of ladle in which no metal is allowed to escape at the bottom while descending, we think invention is not involved in applying such feature to the species of Fig. 1 by completely closing the bottom.

Claims 19 and 20 are directed to the formation of the bowl of the ladle without reference to any handle on the ladle. Considered as a mere ladle, we agree with the
89 examiner's conclusions that these claims fail to present patentable matter over Hosack or Ennor. Ennor et al employ a ladle with an imperforate bottom. The overflow takes place over the top of the ladle rather than through an opening in the side but Ennor et al provide a baffle 8 above and around the sides which is equivalent to applicants' shield portion C.

Claims 21 and 22 add to the structure of claims 19 and 20, respectively, certain limitations concerning a handle. Claim 21 only requires a handle very broadly. Such handle in similar relation on a distributing ladle is shown by Walker and we believe equivalently in the supporting means for each of the ladles of either Hosack or Ennor.

While claim 22 adds limitations which are substantially those of allowed claim 15, we are not convinced that these details are such as to be particularly dependent upon or cooperative with this ladle and that mere association of these features broadly do not constitute additional invention, that is, the specific details of handle 22 do not particularly cooperate with this ladle in such new or unobvious way to produce invention over claim 15 in view of the art.

We have given full consideration to the extended remarks presented by the brief in connection with the affidavit of record as to the results accomplished as compared to simple or direct pouring. It is not doubted that this method and apparatus constitute an improvement over simple pouring but we are convinced that the whole principle and equivalent steps and apparatus are disclosed by the prior art as above discussed and applied.

90 The decision of the examiner is affirmed.

HENRY VAN ANDEL
Assistant Commissioner
W L REDROW
Examiner-in-Chief
C H SHAFFER
Examiner-in-Chief

Board of Appeals

January 19, 1937

(No Model.) 3 Sheets—Sheet 1.

A. L. WALKER.

APPARATUS FOR CASTING METALS.

No. 597,367. Patented Jan. 11, 1898.

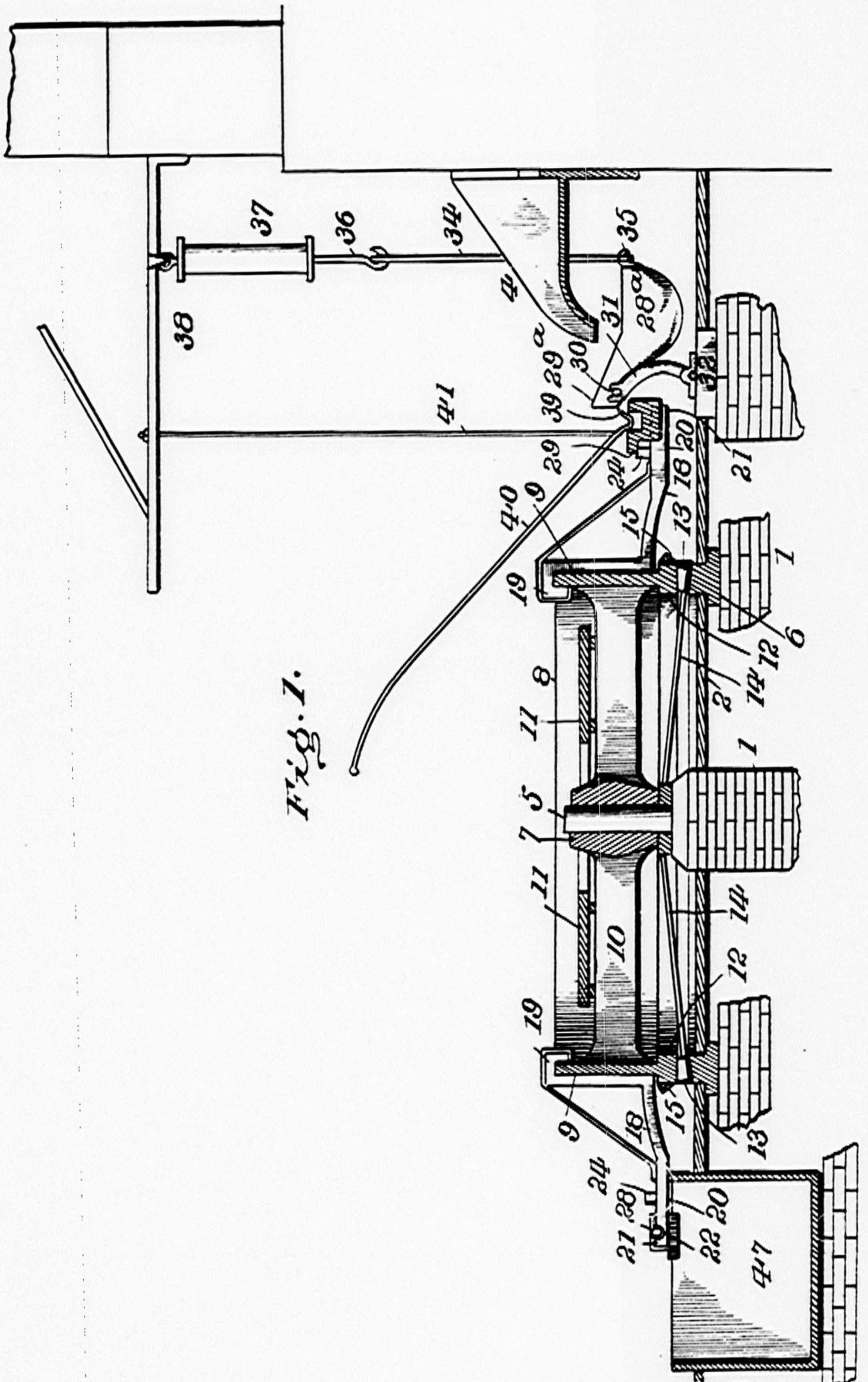


Fig. 1.

Witnesses
Jno Minnie
C.C. Hines

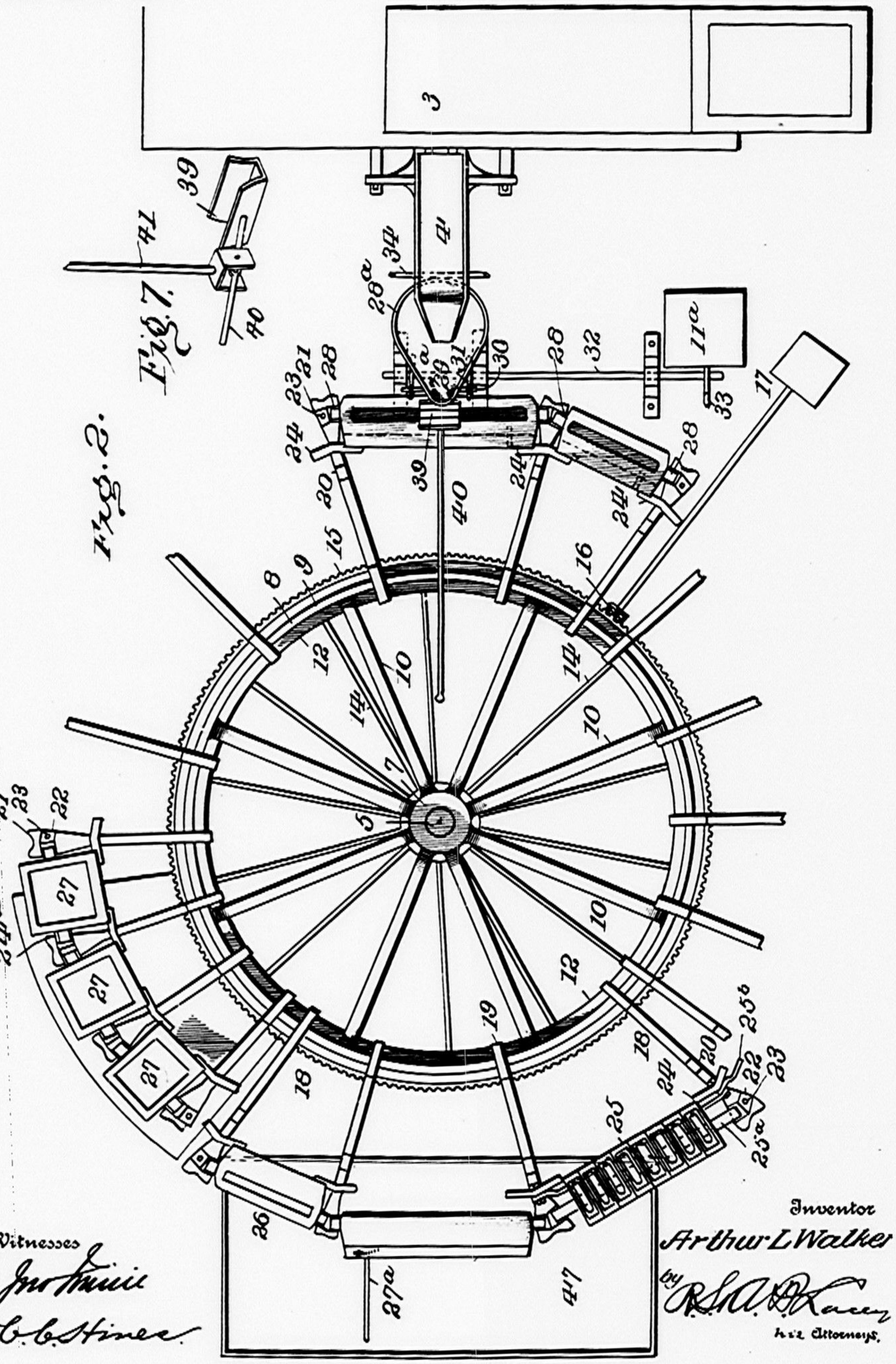
Inventor
Arthur L. Walker
by R.S. & A.B. Lacey,
his Attorneys.

(No Model.) 3 Sheets—Sheet 2.

A. L. WALKER.

APPARATUS FOR CASTING METALS.

No. 597,367. Patented Jan. 11, 1898.



Witnesses
Jno Finnie
C. C. Hines

Inventor
Arthur L Walker
by R.S. & A.B. Lacey
his Attorneys.

(No Model.) 3 Sheets—Sheet 3.

A. L. WALKER.

APPARATUS FOR CASTING METALS.

No. 597,367. Patented Jan. 11, 1898.

Fig. 3.

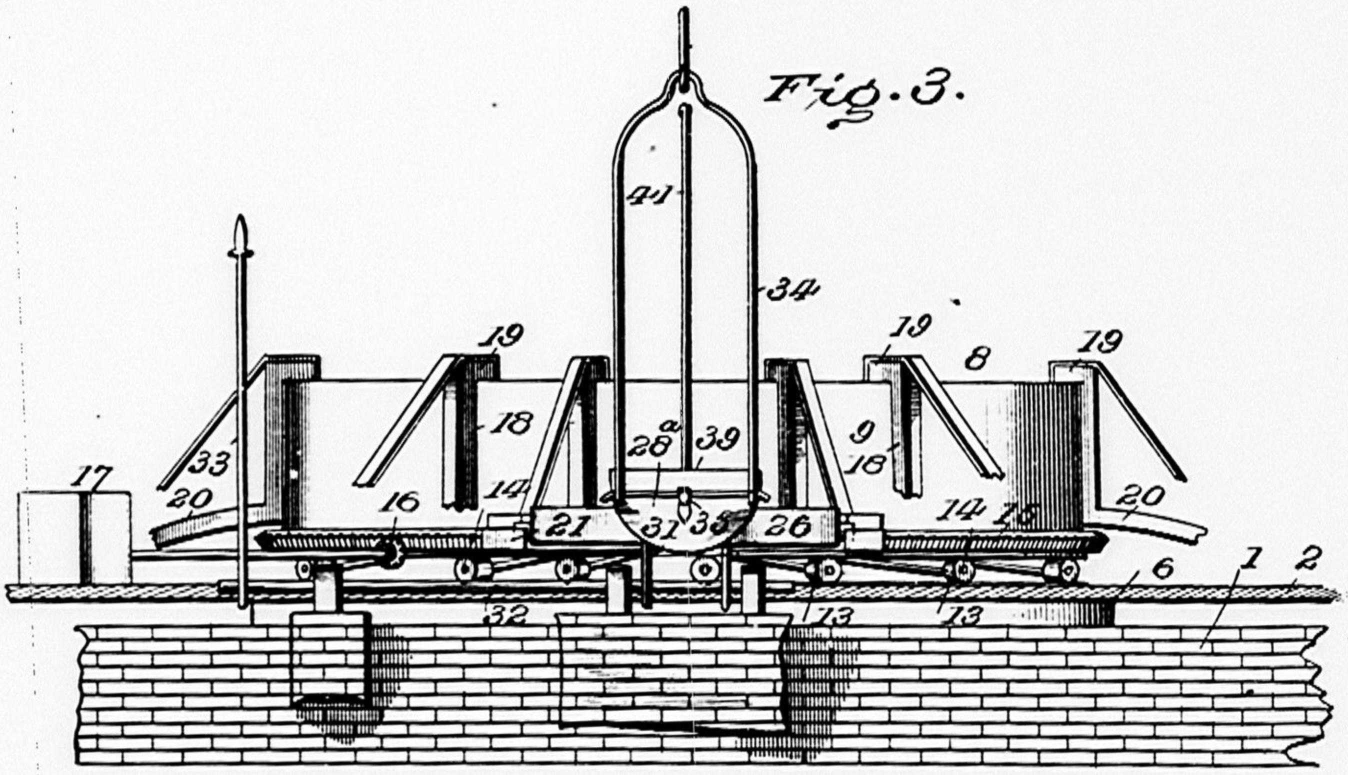


Fig. 4.

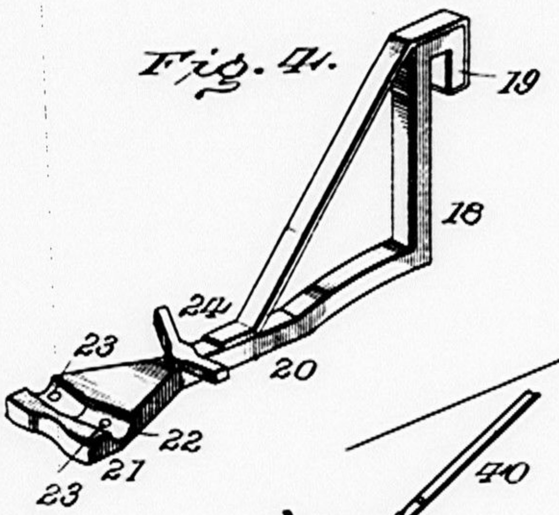


Fig. 5

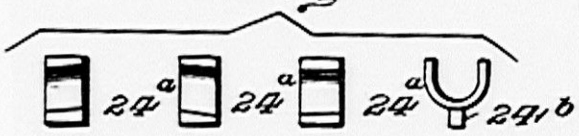
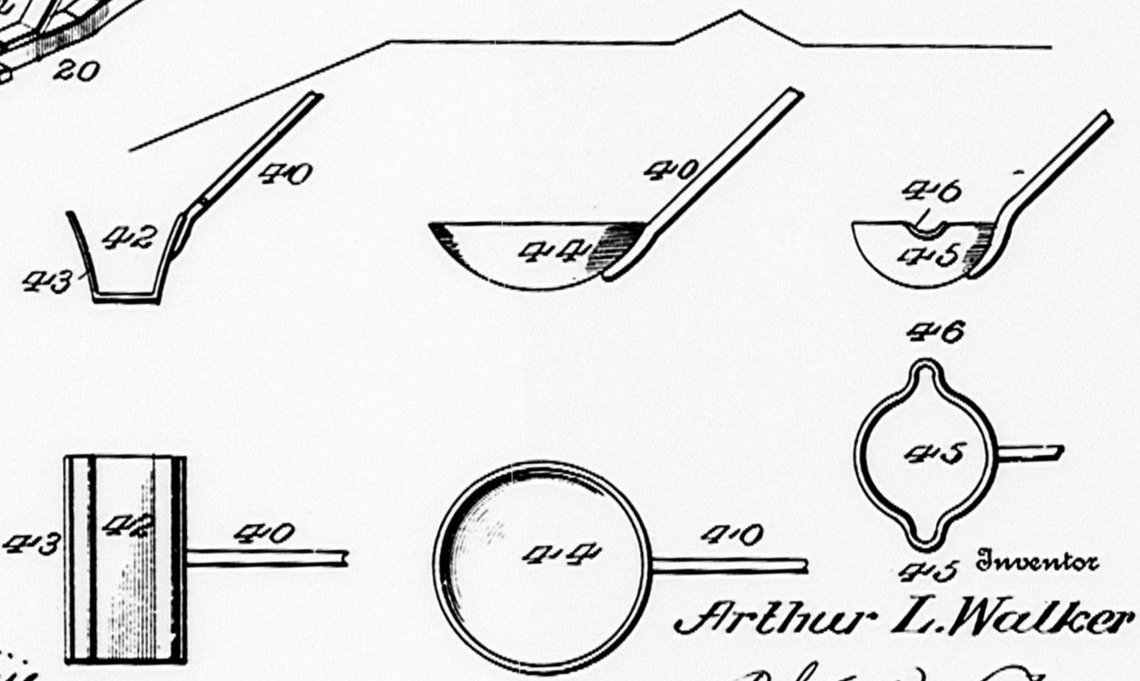


Fig. 6.



Witnesses

Jno Finnie

C. C. Hines

Inventor

Arthur L. Walker

by R. S. & A. B. Lacey

Attorneys

UNITED STATES PATENT OFFICE.

ARTHUR L. WALKER, OF BALTIMORE, MARYLAND.

APPARATUS FOR CASTING METALS.

SPECIFICATION forming part of Letters Patent No. 597,367, dated January 11, 1898.

Application filed July 22, 1897. Serial No. 645,588. (No model.)

all whom it may concern:

Be it known that I, ARTHUR L. WALKER, a citizen of the United States, residing at the city of Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Apparatus for Casting Metals; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention has reference to improvements in apparatus for casting metals, especially those which are ladled or tapped out of the furnace, such as copper, and poured into molds; and it relates more particularly to casting apparatus of that type wherein the molds are mounted upon a rotary table or carrier and are thereby successively brought into position to receive the molten metal from the ladle and thence conveyed to the bosh or a dry pit, where the castings are dumped.

The object of the invention is to improve generally the construction of casting apparatus of this character and to provide improved ladling and mold-carrying mechanism whereby the successive operations of casting on a large scale may be accomplished with great rapidity, safety, at small cost, and with a minimum amount of labor and without waste.

With this and other objects in view the invention consists in the novel constructions and combinations of parts hereinafter more fully described, and particularly pointed out in the appended claims.

In the accompanying drawings, Figure 1 is a sectional elevation of a casting apparatus constructed in accordance with my invention; Fig. 2, a plan view of the same; Fig. 3, an elevation looking toward the front; Fig. 4, a detail perspective view of one of the mold-supporting brackets; Fig. 5, a detail view showing the bushings. Fig. 6 is also a detail view showing the forms of metal-deflectors employed. Fig. 7 is a detail of the hanger-rod and deflector device.

Referring to the drawings, 1 represents a suitable brick or stone foundation, 2 a floor laid thereon, and 3 a furnace from which the molten metal is discharged by means of a spout 4. 5 is a fixed shaft projecting up from said foundation, and 6 a circular track-rail laid on the floor concentric with said shaft. On this shaft is loosely mounted the hub 7 of a horizontal rotary carrier wheel or table 8. This wheel or table comprises a broad rim 9, secured to the hub by radial arms 10 and provided with a deck-platform 11 and a broad base-bearing 12, and antifriction cone roller-bearings mounted upon the shafts 14 are interposed between the track-rail and said base-bearing. The carrier-table may be revolved by the provision of any suitable mechanism, but in the present instance I have shown the rim provided on its outer face with a rack 15, with which gears a pinion 16 on the armature-shaft of a motor 17.

18 represents mold-carrying brackets which are each provided at its upper end with a hook 19 to engage the upper edge of the wheel-rim and at its lower end with an arm 20, having at its outer end a flaring head 21, formed with an angular transverse recess 22 and pivot-openings 23. At the rear end of said head each arm is provided with an angular cross-bar 24.

The wire-bar molds 26 and cake-molds 27 are of unequal length and different shape, as usual, but of like construction, each having trunnions 28, which are journaled in the recesses 22, and rear bearing-flanges 29, adapted to rest upon the said cross-bar. The trunnions 28 are located between the center of gravity of the mold and the front end thereof, and the mold is normally held supported by its flange resting upon the cross-bar 24. The ingot-molds 25, instead of having trunnions, are provided with a carrying bar or shaft 25^a, on which they are adapted to revolve. The ends of the carrying bar or shaft are laid in the bushings (hereinafter described) in the same manner as the trunnions of the wire-bar and cake molds, and the ingot-mold when in horizontal position rests at its rear end on a bar 25^b, bolted to two adjoining supporting-arms, as shown. The different molds denoted are of unequal length, and when the brackets are adjusted to receive a long or short mold a bushing 24^a is inserted in the recess 22. These bushings are formed with a lug or projection 24^b to pivot in the openings 23 and with angular slots, whereby provision is made for changing the angles of the slot to compensate for the differences in the angles made by the axes of different lengths of molds relatively to the body of the bracket. Thus provision is made to enable any size or shape of mold to be used in this apparatus. If it is desired to support two brackets in fixed relation, a cross connecting-bar 25^b is employed, and such a construction is preferably adopted when an ingot-mold is being supported, as hereinbefore described, for the reason that while the shaft of the same is very long comparatively the body and flange are relatively too short to rest upon the cross-bar 24. An ordinary dumping-hook will be used for tilting and dumping small molds, while a bar 27^a will be used for dumping heavy molds, as shown.

Interposed between the carrier-wheel and furnace is the ladle 28^a. This ladle is formed with a contracted upwardly-inclined spout 29^a, having a narrow pouring-lip and trunnions 30 at opposite sides adjacent said lip. These trunnions are journaled in the upper ends of curved bearing-arms 31, mounted upon a shaft 32, and a lever 33, secured to said shaft, is provided for oscillating the shaft to move the inclined spout and pouring-lip of the ladle to a horizontal position. By this construction it will be seen that the arc described by the ladle-spout in assuming a pouring position to discharge the metal into a mold is very small and that the metal flows directly from said spout upon the deflector and cannot on account of its inconsiderable fall splash or chill. The rear end of the ladle is supported by a yoke-hanger 34, the lower cross-bar of which engages a hook 35 thereon. The upper end of said yoke is connected with the plunger-rod 36 of a hydraulic lift supported by a bracket-arm 38, the function of said hydraulic lift being to raise and lower the body portion or rear end of the ladle. Suitable operating mechanism for controlling the action of the hydraulic lift will be provided and located so as to be accessible to an attendant standing on the platform 11^a. The mouth or pouring-lip of the ladle is arranged adjacent to the path of rotation of the molds, and owing to its peculiar construction and manner of hanging has such a limited movement that the flow of molten metal discharged therefrom is smooth or uninterrupted, and splashing of the same is thereby prevented. In order to further insure the delivery of the metal to the mold and obviate all liability of clinging, splashing, or "cold-setting," I have provided a guide or deflector 39, adapted to receive the metal flowing from the ladle and secured to a handle 40, pivoted to a hanger-rod 41, suspended from the bracket-arm 38, said handle being accessible to an attendant standing on the carrier-platform 11. By this construction and arrangement the attendant on the platform 11^a may control the hydraulic lift and lever 33 and the attendant on the rotary-carrier platform hold the deflector in position to guide the flowing molten metal and at the same time operate the mechanism controlling the rotation of the carrier.

Different forms of deflectors are preferably employed for guiding the metal to different kinds of molds. The deflector 42, having the curved guide-lip 43 and open sides, is employed in connection with wire-bar molds, which are long enough to enable the metal to flow thereinto from both sides of the deflector. The semihemispherical deflector 44 is employed in connection with cake-molds and the deflector 45, having the pouring-lips 46 at opposite sides, with ingot-molds, which require the metal to be poured into them, the double lips of the ingot-deflector enabling the metal to be poured into the mold-chambers on opposite sides of said deflector with ease and facility. By the provision of these deflectors and the peculiar construction and manner of hanging the ladle all liability of the flowing metal to cold-set or core, splash, or cling is obviated and the casting of a solid cake, bar, or ingot insured.

The operation is as follows: The molten metal is allowed to run out of the spout 4 into the ladle until the latter is full or contains a sufficient amount for use. The ladle is then tilted to discharge the metal into the mold on the rotary carrier opposite it and under its lip, and when said mold is filled the ladle is lowered and the rotary carrier revolved to bring the next mold into operative position to be filled in the same manner until one-half of the molds are filled. The position of the molds and correlative parts is such that by the time the filled mold reaches the water-bosh or dry pit 47 the castings are solid, and the molds are then dumped, in the manner hereinbefore described, to discharge the castings and are then cooled with water and prepared to be filled again when next under the ladle. The castings may be lifted out of the bosh or dry pit by any approved means, such as a lift or conveyer. An important advantage is that in my apparatus the molten metal is handled and cast at a position remote from the water-bosh, thus rendering the operation very much safer.

From the above description, taken in connection with the accompanying drawings, it will be seen that I have provided a casting apparatus by which a large number of castings may be quickly and cheaply made without flaws and a large amount of time and labor saved over the ordinary casting operation, thus reducing the cost considerably. With my apparatus the entire operation of casting may be carried out by two attendants, one standing on the carrier-platform 11 and the other on the floor-platform 11^a.

I desire it understood that I do not limit myself to the specific details of construction herein shown and described, but reserve to myself the right to make such changes in the form and arrangement of the various parts of the apparatus as fairly fall within the spirit and scope of my invention.

Having thus fully described my invention, what I claim as new and useful, and desire to secure by Letters Patent of the United States, is—

1. In casting apparatus, the combination with a ladle, of a circular track laid upon a fixed foundation, a shaft fixed to said foundation and arranged concentric with said track, a carrier-wheel resting on and supported wholly by the track and mounted on said shaft to have a determined or fixed plane of rotation, mold-carrying brackets adjustably hung upon the rim of said carrier-wheel, and a mold mounted in two adjacent brackets, whereby a series of removable molds of different kinds may be supported upon the rim of the carrier-wheel, substantially as described.

2. In casting apparatus, the combination of a shaft, a carrier-wheel rotatably mounted thereon, mold-carrying brackets hung upon the rim of said wheel and adjustable thereon relatively to each other, and a mold mounted in two adjacent brackets, whereby a series of removable molds of different kinds may be supported upon the rim of the carrier-wheel, substantially as described.

3. In casting apparatus, the combination of a shaft projecting up from a fixed floor-foundation, a circular track laid upon said foundation and arranged concentric with the shaft, a carrier-wheel rotatably mounted on said shaft and having its rim formed on its under side with a base-bearing and on its outer side with rack-teeth, conical antifriction-rollers 13 mounted on shafts 14 and interposed between said track-rail and the base-bearing of the carrier, a driven gear-wheel meshing with said rack-teeth, mold-carrying brackets adjustably connected with the rim of the wheel, and a mold mounted in two adjacent brackets, whereby a series of removable molds of different kinds may be supported upon the rim of the carrier-wheel, substantially as described.

4. In casting apparatus, the combination of a circular track, a shaft arranged concentric therewith, a carrier-wheel consisting of a hub rotatably mounted on said shaft, spokes or arms radiating therefrom and a broad annular rim secured to said arms and provided with a broad base-bearing, antifriction-bearings interposed between said base-bearing and the track, detachable mold-carrying brackets, each provided with a hook engaging the rim of the carrier-wheel and adjustable thereon, and a mold mounted in two adjacent brackets, whereby a series of removable molds of different kinds may be supported upon the rim of the carrier-wheel, substantially as described.

5. In casting apparatus, a rotatable mold-carrier wheel, a series of mold-supporting brackets adjustably hung on the rim of said wheel, each bracket having an arm projecting beyond said rim and provided with a bearing, and a mold provided with trunnions adapted to be mounted in the bearings of two adjoining bracket-arms, whereby an annular series of removable molds of different kinds may be supported upon said bracket-arms around the outer circumference of the rim of the wheel, substantially as described.

6. In casting apparatus, a rotatable mold-carrier wheel, a series of mold-supporting brackets adjustably connected with the rim of said wheel, each bracket having an arm provided with an angular bearing-recess, a mold provided with trunnions mounted in the bearing-recess of two adjoining arms, and bushings adapted to be inserted in said bearing-recesses to vary the angles of inclination thereof, whereby molds of different length may be supported, substantially as described.

7. In casting apparatus, a rotatable mold-carrier wheel, a series of mold-supporting brackets adjustably connected with the rim of said wheel, each bracket having an arm provided with a bearing-recess and a cross-bar in rear thereof, and a mold provided with trunnions arranged between the center of gravity and the front end thereof, and journaled in said recesses, and provided with a bearing-flange at its rear adapted to rest upon said cross-bar, substantially as described.

8. In casting apparatus, a rotatable mold-carrier wheel, a series of mold-supporting brackets adjustably connected with the rim of said wheel, each bracket having an arm provided with a bearing-recess and a cross-bar in rear thereof, a mold provided with trunnions arranged between the center of gravity and front end thereof and journaled in said recesses and provided with a bearing-flange at its rear adapted to rest upon said cross-bar and means for tilting the molds to dump the castings, substantially as described.

9. In casting apparatus, the combination with a furnace having a discharge-spout, of a mold-carrier, a tilting ladle arranged between the spout and mold-carrier, a supporting bracket-arm above said ladle, a lift supported by said bracket-arm, a connection between said lift and the rear end of the ladle, a hanger suspended from the bracket-arm, and a deflector device 39 connected with said hanger and provided with a handle 40 projecting toward said mold-carrier, substantially as described.

10. In casting apparatus, the combination with a furnace, of a rotatable mold-carrying wheel provided with mold-supporting brackets, a rock-shaft, bracket-arms rigidly secured to said shaft, a ladle interposed between the furnace and mold-carrier and having a mouth provided on opposite sides with trunnions journaled in said bracket-arms, and means for supporting and tilting the rear end of the ladle, substantially as described.

11. In casting apparatus, the combination with a furnace, of a rotatable mold-carrier wheel provided with mold-supporting brackets, a rock-shaft, bracket-arms rigidly secured to said shaft, a ladle interposed between the furnace and mold-carrier and having a mouth

provided on opposite sides with trunnions journaled in said bracket-arms, a supporting bracket-arm, a connection between the bracket-arm and rear end of the ladle for supporting the same, a lever connected with the rock-shaft, and a deflector suspended from said bracket-arm above the mold and provided with a handle projecting over toward the carrier, substantially as described.

12. In casting apparatus, the combination of a furnace having a discharge-spout, a bracket, a tilting ladle having a contracted mouth and pivoted adjacent to said mouth, a hydraulic lift supported by said bracket, a connection between said lift and the rear end of the ladle, a hanger-rod also supported by said bracket, and a deflector device carried by said rod adjacent the mouth of the ladle, substantially as described.

13. The combination with a furnace, having a discharge-spout, of a rotary mold-carrier provided with mold-supports, a tilting ladle interposed between said spout and carrier and provided with a pouring-lip arranged vertically above the path of rotation of the molds and adapted to discharge the molten metal directly into a mold on said carrier, and a pivoted deflector device comprising a pan or vessel arranged when in operative position to rest within the mouth of a mold, substantially as described.

14. In an organized casting apparatus, the combination with a furnace having a discharge-spout, of a rotary mold-carrier adapted to be given an intermittent, step-by-step movement to successively bring each mold carried thereby in line with said spout, a ladle arranged under the spout with its pouring-lip located just above the path of the molds, and pivoted adjacent to said lip so that when tilted slightly it will discharge the metal directly with a minimum fall into the mouth of the mold beneath it, means for tilting said ladle, and a pivoted deflector device comprising a pan or vessel arranged when in operative position to rest within the mouth of a mold, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

ARTHUR L. WALKER.

Witnesses:
DAVID S. POPE,
ALBERT H. WELD.

H. H. HOSACK.

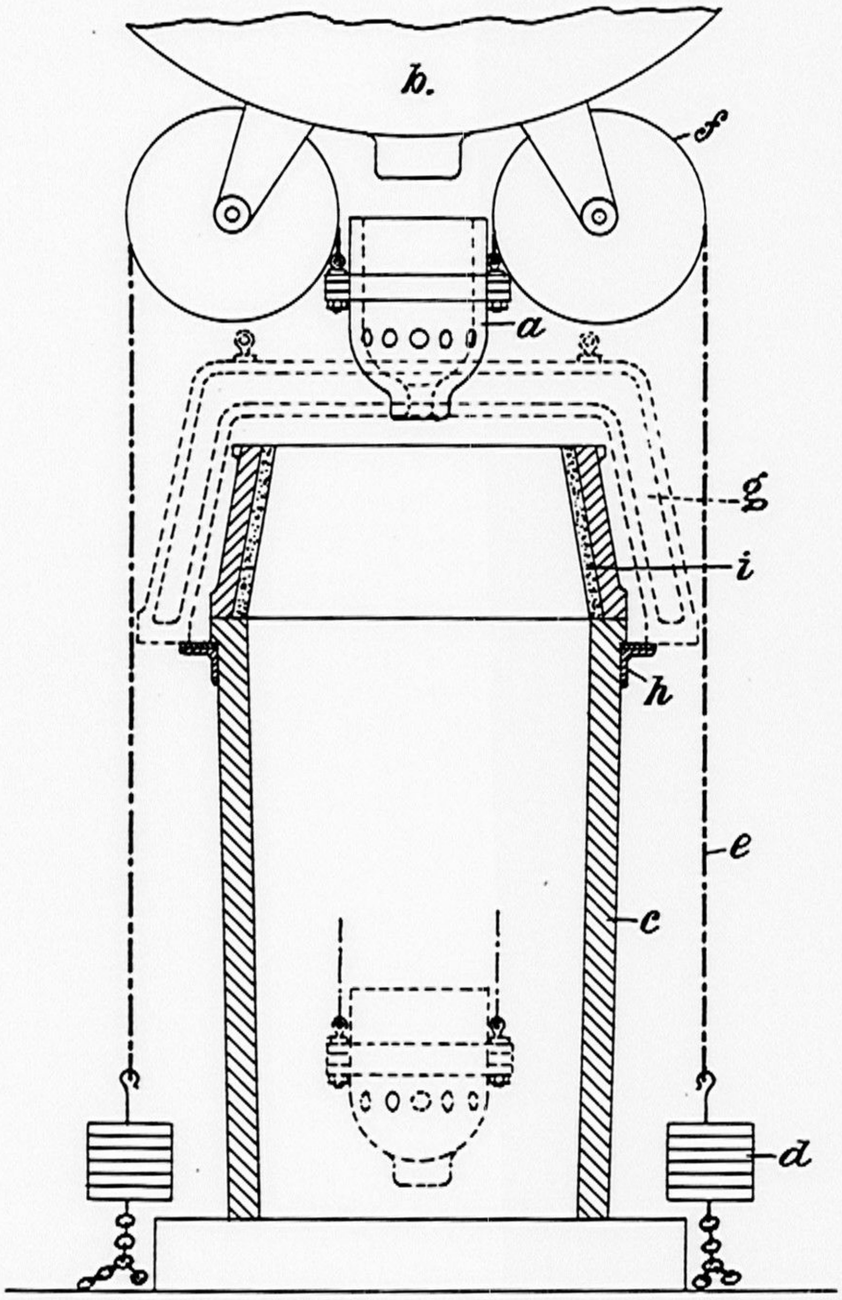
APPLIANCE FOR CASTING METAL INGOTS INTO MOLDS.

APPLICATION FILED AUG. 28, 1919.

1,375,589. **Patented Apr. 19, 1921.**

2 SHEETS—SHEET 1.

FIG. 1.



Inventor

H. H. Hosack

By

Attorney

H. H. HOSACK.

APPLIANCE FOR CASTING METAL INGOTS INTO MOLDS.

APPLICATION FILED AUG. 28, 1919.

1,375,589.

Patented Apr. 19, 1921.

2 SHEETS—SHEET 2.

FIG. 2.

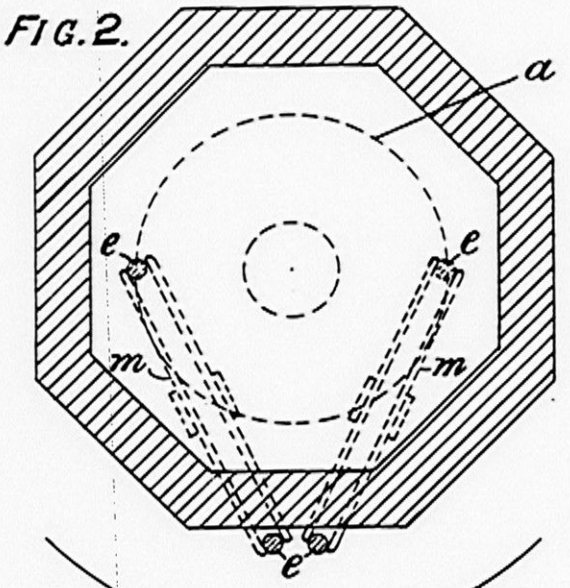


FIG. 3.

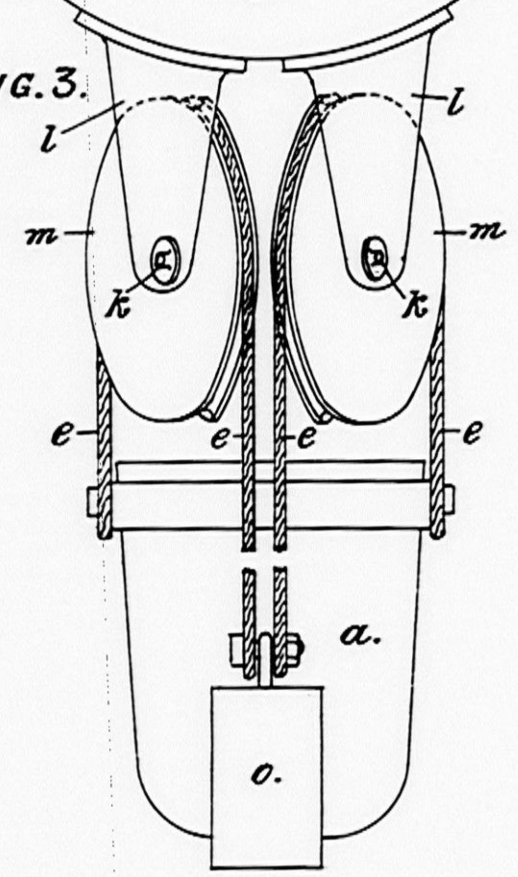


FIG. 4.

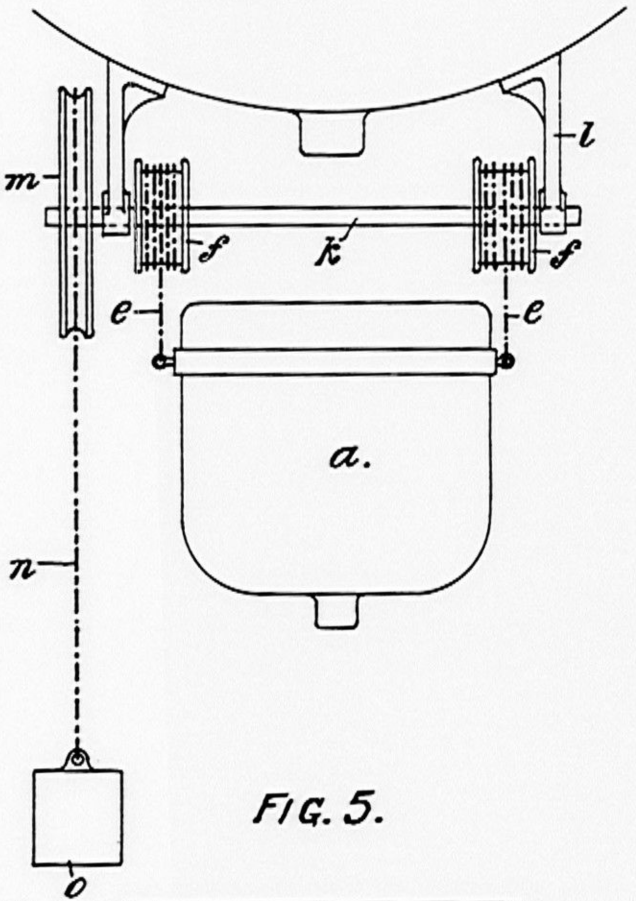


FIG. 5.

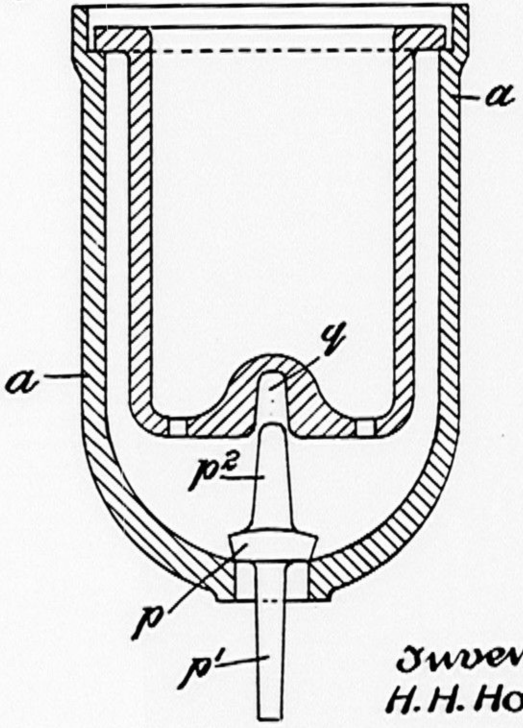
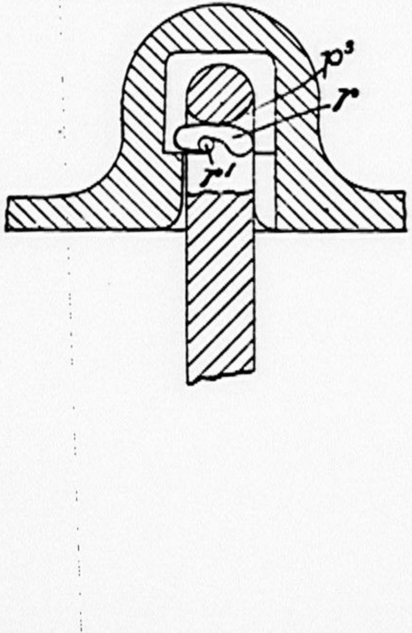


FIG. 6.



Inventor
H. H. Hosack

By
Attorney

UNITED STATES PATENT OFFICE.

HAROLD HERON HOSACK, OF TWICKENHAM, ENGLAND.

APPLIANCE FOR CASTING METAL INGOTS INTO MOLDS.

1,375,589. Specification of Letters Patent. **Patented Apr. 19, 1921.**

Application filed August 28, 1919. Serial No. 320,422.

To all whom it may concern:

Be it known that I, Harold Heron Hosack, a subject of the King of England, residing at Twickenham, in the county of Middlesex, England, have invented new and useful Improvements in Appliances for Casting Metal Ingots Into Molds, of which the following is a specification.

This invention has reference to the pouring or teeming of molten steel and other metals into molds generally called ingot molds; and it has primarily for its objects and effects to diminish or obviate splashing of the metal when poured into the ingot mold from above, and thereby to diminish as far as possible the oxidization of the metal, and other deteriorating effects upon or in the metal due to such splashing, and the present method of pouring or casting.

According to this invention, the molten steel (or other metal) which is run from a furnace into a movable casting ladle or container, is not directly run or delivered from this ladle or container into the mold, but is introduced into it through the intermediary of a vessel—which may be called a "pilot ladle"—which is adapted to rise and fall and receives it from the main ladle or container, and in turn delivers it, when at or near the bottom of the mold, into the mold, so that its discharge or delivery is at a very small head, and quietly and as the mold fills, the pilot ladle is caused to rise, so that the splashing and carrying down of air bubbles into the metal, is to a very large extent obviated.

According to one mode of carrying out this method or system of pouring or casting, the vertically movable pilot ladle (which will come directly under the main ladle, and may be supported therefrom or from the upper part of the ingot mold) is counter-balanced, the weights being such as to keep it when empty, in its uppermost position at the required position under the ladle pouring spout; but when it receives metal from the ladle, which is delivered to it by lifting a plug as usual, the weight of the molten metal and that of the pilot ladle exceeds that of the counter weights, and the pilot ladle falls, lifting the weights; and it is carried down to near the bottom of the ingot mold; and the metal from the pilot ladle flows relatively slowly in a quiet stream or streams from the pilot ladle into the bottom of the mold. As the level of the metal rises in the mold, and reaches the pilot ladle, the diminution of the specific gravity of it, due to the pressure of the molten metal of the mold, will cause it to rise as the mold fills; and when it is completely filled, and the stopper or plug of the main ladle or container closed, the pilot ladle will empty itself, and rise clear of the mold, being pulled up by the counterbalance weights.

When an ingot mold has been filled, the ladle is moved over another mold, and the operations above described will be repeated.

In some cases, the pilot ladle may be of ordinary metallurgical crucible material; while in other cases it may consist of a metal shell, with a fire brick or refractory material lining.

According to a modification, the vertically moving pilot ladle may, instead of being entirely automatic, partly automatic that is controlled by an attendant; or it may be moved down and up into and out of the ladle by hand operated or mechanical, say an electrically operated means.

Also in some cases, a valve or plug device may be used in the pilot ladle, which will be operated and opened at the right time, when the pilot ladle is at the required depth or position in the mold. Also this ladle may be heated to any desired degree before pouring takes place.

The mold may have a sinking head on its upper end of any known suitable kind.

The system according to this invention is illustrated in the accompanying drawings, in which Figure 1 is an elevation in section showing one arrangement of parts. Figs. 2 and 3 are plan and elevation showing a modified arrangement; and Figs. 4 and 5 are two other modifications; while Fig. 6 shows a detail.

Referring first to Fig. 1, *a* represents the pilot ladle, *b* the traveling pouring ladle, and *c* the ingot mold. *d* are the counterbalance weights, and *e* the chains or ropes connecting the pilot ladle with the weights, they being passed over the pulleys *f* on the bottom of the ladle *b*. The sinking head is marked *i*, and is provided with a sand internal lining as shown.

The dotted part marked *g* represents a hollow jacket or hood, the interior space of which would be exhausted of air, and put under a vacuum. This hood stands over the sinking head, and the lower edge of it rests on an asbestos or other packing, carried by the angle iron ledge *h* on the mold.

The pilot ladle *a* has a hole in its bottom, and in some cases a plurality of holes around it, as shown, in Fig. 1, so that it discharges its contents in a multiplicity of quiescent streams.

Before pouring, the pilot ladle takes the upper position shown in the drawing; and when the main ladle stopper is lifted, the metal pours into the pilot ladle, and the combined weight of this metal and ladle causes the latter to fall to as near the bottom as desired, say about the position shown in the dotted lines in the drawing; and so the length the streams from the holes in it, falling on to the bottom of the mold is short.

As the metal in the mold rises, its action on the pilot ladle in rising is to take off weight from it; and the counterbalance weights *d* being then slightly heavier than the weight of the pilot ladle, will cause it to rise as the metal rises; and the metal from the orifices of the pilot ladle flows quietly and evenly without splashing, or carrying down of air into the cast metal, from the commencement of pouring to the end; and when the mold is entirely filled, and the main ladle stopper shut down, the weights *d* will pull the pilot ladle clear of the sinking head *i*, when it is ready for a similar operation with the next mold in the bench of molds.

Having by these means cast an ingot, as free from splashings, and inclusions of air as possible, this advantage is followed up by providing means of feeding the contents of the mold with hotter steel or metal than is contained in it; and this is effected by the employment of the vacuum hood *g*, which immediately after casting is placed over the sinking head, as indicated in the drawing; the conduction of heat by the hood away from this portion of the mold, being prevented or reduced by the asbestos or like joint of the supporting ledge *h* above specified. The metal in the upper portion of the ingot is then kept liquid for as long a period as possible, and serves to feed the main bulk of the ingot, as the metal cools from the bottom upward.

In the modification shown in Figs. 2 and 3, instead of there being separate weights, only one weight *o* is employed, both chains or ropes *e* passing over the pulleys *f* which are inclined toward one another as shown.

In the arrangement in Fig. 4, the pilot ladle *a* is supported by chains or ropes *e*, and pulleys *f*, from a shaft *k*, carried in bearing supports *l* from the bottom of the ladle *b*; and this shaft has fixed upon it a chain or rope pulley *m*, the rope or chain *n* of which has a weight *o* on the bottom, so as to counterbalance the pilot ladle *a*. On or connected with this gear or tackle, any desired form of brake (not shown) may be used, so that the operation of the pilot ladle may be governed or controlled.

In the case of the invention being applied to casting of large ingots in large molds, the pilot crucible *a* should be as large as possible; and in operation, in some cases, it is first filled from the main ladle or container, while in the upper position, being held when filling by a brake or equivalent gear on the mechanism, hand or mechanically operated; and when full the main ladle stopper should be closed, and the pilot ladle *a* may be lowered to the bottom of the mold. This ladle *a* may have a discharge control stopper or valve, operated by hand from above, similarly to an ordinary casting ladle stopper, or automatically as hereinafter described, by striking the bottom of the mold; and when the pilot ladle is near the bottom of the mold and the valve or stopper is opened, the metal will pour from the lower pouring spout in its bottom, quietly onto the bottom of the mold, and flush the lower portion of same. As soon as the metal is released from the pilot ladle, the main ladle stopper may be opened so as to discharge into the pilot ladle, which being acted upon by the rising metal run into the ingot mold, will by means of the counterbalance weight acting upon it, be lifted as the metal rises, similarly as above described.

In some cases, however, it may be preferred that the upward or downward movement or both of the pilot ladle may be effected mechanically as by an electric motor, or by hand, and when the mold is filling it will be lifted, which can be indicated by a floater device in the mold, or other means; but so far as the first operations of the system are concerned, these may be controlled by a brake, or pawl and ratchet, or the like.

In Fig. 5, a double construction of pilot ladle is shown, having an automatic stopper or valve *p* in the bottom of the outer part with a lower stem p^1, and an upper stem p^2, the latter of which when lifted, due to the stem p^1 striking the bottom of the mold in lowering, will be pushed up into the tapered socket hole *q* of the inner ladle, and so thereby held. The molten metal will be received by the inner vessel of the ladle, and passed through the holes in the bottom, of which there are a multiplicity, and then out by the central hole in the bottom of the outer ladle wall.

By this means the quiescent falling of the liquid metal, and its discharge into the ingot mold is promoted; and the avoidance of the carrying down of air into the metal in the mold is accomplished.

Instead of the plug or valve *p* being held up by friction as just described, it may be held up by a detent as shown in Fig. 6. The detent in this case is in the form of a weighted pawl r, supported on a cross pin r^1, in a recess or opening in the upper stem p^2. When the stopper is being lifted, the nose of this pawl will be pressed into the recess p^3 in the stem p^2, by passing over the surface of the material around the hole q, and when the nose of the weighted pawl enters the enlarged upper part q^1 of the hole q, it rises, and projects into the hole, so that when the stopper lower stem leaves the bottom of the mold, the stopper will be held up in the open position.

To lower the stopper, it is turned around so that the nose of the pawl r comes over a vertical groove or slot way q^3 through the material forming the lower part of the hole q, so that it can fall down; and then afterward, it is turned around so that the nose would be away from this slot q^3, and in a position ready for the stopper being lifted.

From the above description it will be apparent that the pilot ladle in effect floats upon the surface of the molten metal and is elevated by the buoyancy added by the counterweights. The counterweights will of course assist in holding the pilot ladle upright and operating to maintain its position about centrally of the main mold.

What is claimed is:—

1. The herein described method of casting metal from a ladle, consisting in delivering the metal from said ladle into a pilot ladle counterbalanced to maintain said pilot ladle floating on the surface of the metal rising in the mold, whereby to maintain the pilot ladle constantly at the level of the rising metal in the mold to deliver the metal from the pilot ladle at or near the surface of the metal in the mold.

2. A means for delivering molten metal into a mold comprising in combination a pilot ladle adapted to receive the molten metal from a supply, and mounted for movement vertically in the mold, and means for counterbalancing the pilot ladle to maintain said pilot ladle as a floating element on the surface of the metal in the mold.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HAROLD HERON HOSACK.

Witnesses:
GEO. P. S. KELSEY,
ERNEST PASK.

Dec. 11, 1934. E. M. CHANDLER **1,983,578**

METAL TRANSFER

Filed Dec. 3, 1932

Fig.1.

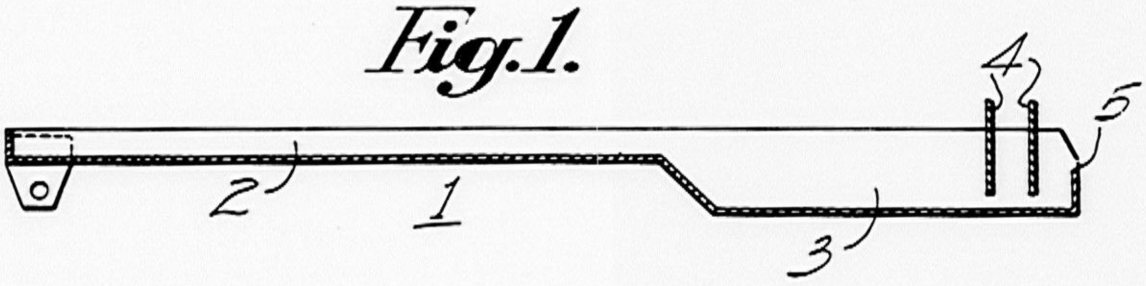


Fig.2.

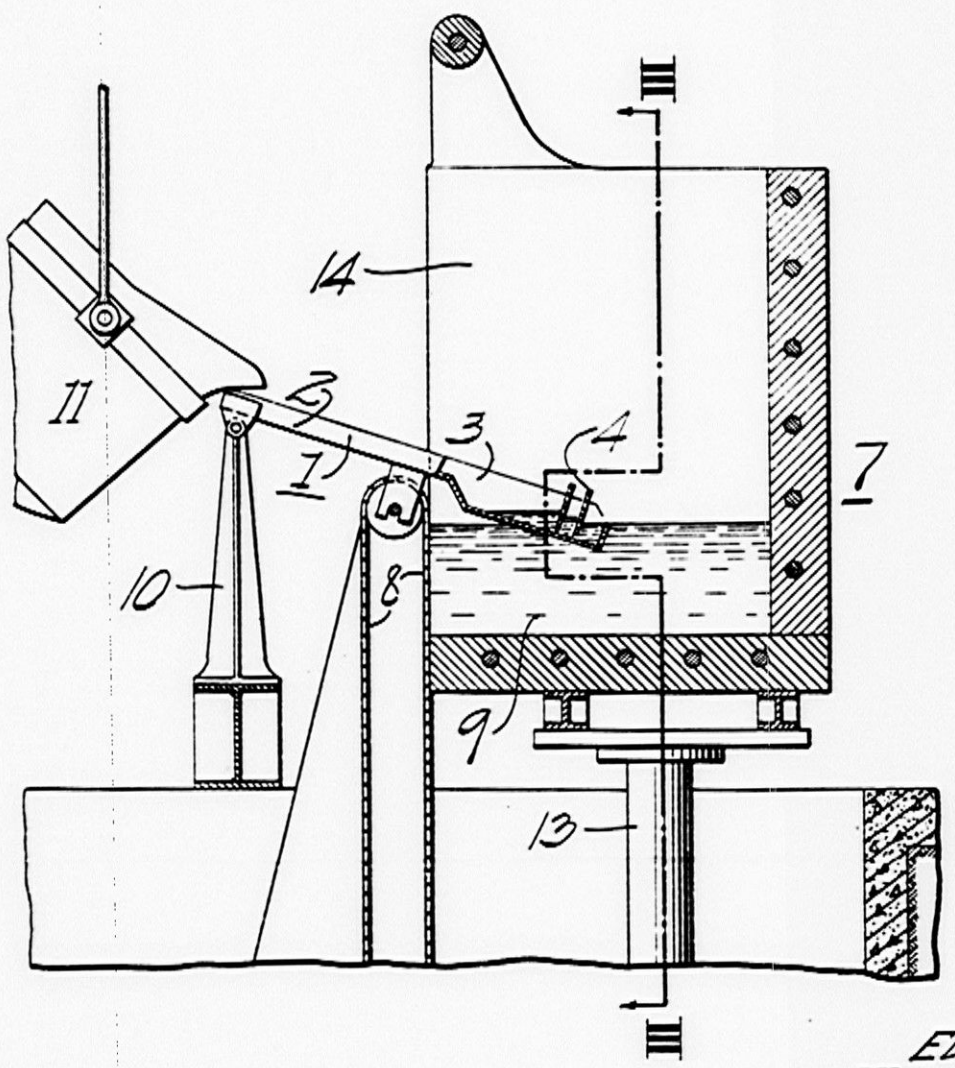
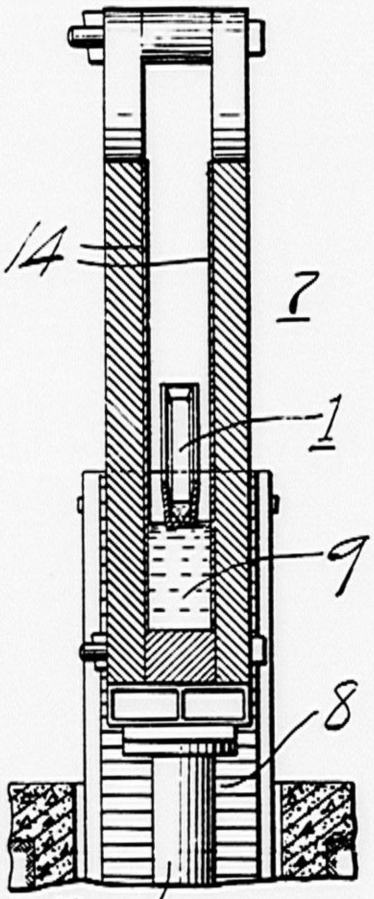


Fig.3.



INVENTOR

EDWARD M. CHANDLER

BY

ATTORNEY

UNITED STATES PATENT OFFICE

1,983,578

METAL TRANSFER

Edward M. Chandler, Alcoa, Tenn., assignor to
Aluminum Company of America, Pittsburgh,
Pa., a corporation of Pennsylvania

Application December 3, 1932, Serial No. 645,507

8 Claims. (Cl. 22—209)

This invention relates to the transfer of molten metal. It relates especially to the quiet transfer of molten metal from one container to another such as from a crucible to a mold, for example, and the simultaneous removal of dross from the metal.

In casting metals, it is always desirable that the amount of metal oxide or dross introduced into the mold with the metal be kept at a minimum. This is especially true in the casting of ingots for rolling, as dross inclusions in such ingots cause defects in the rolled sheets. In casting ingots of the more easily oxidized metals, such as aluminum, for example, special means must, therefore, usually be provided for skimming or otherwise removing dross from the metal after, or preferably during, the casting or pouring operation. With metals of this type, it is also usually necessary to take precautions against excessive oxidation or dross formation which may take place during the casting operation by the entrapment of air or the entrainment of surface oxide film due to cascading the metal poured or otherwise causing a violent turbulence.

When casting in a mold of the open side type the difficulties of securing a sound ingot are greatly magnified, especially when casting ingots of the duplex type having plates of dissimilar metal cohesively attached to their sides during the casting operation. This is a known type of mold, being described in U. S. Patent 1,734,786 to Züblin, for example, and differs from the ordinary top-pour ingot mold in that one side is opened before casting and is progressively closed during the pouring operation by means of a flexible side wall which is pressed against a faced portion of the mold to make a metal-tight seal. In the casting of an ingot of the type mentioned above, plates of aluminum or alloys thereof are placed on opposite sides of the mold in close contact with the walls and molten aluminum or aluminum alloy is poured in the space between, preferably from a central point. The metal cast should be at a temperature at which it will cohesively adhere to the plates after cooling, but should not have such a high temperature or such a violent motion as to melt or vary the thickness of the side plates.

In the past, difficulty has been experienced in securing uniformly sound ingots of this type for several reasons. It is absolutely necessary that the side plates remain intact during the pouring operation. It is also of prime importance that no dross be entrapped with the metal poured or on the surface of the finished ingot. There should not be any violent stream or current in the mold during casting. The metal should be poured from a central point to secure a balanced distribution of heat, but it has been the custom to pour the metal against the side wall of the mold opposite its point of entrance, usually from a trough extending across the mold, to avoid formation of dross due to the turbulence of a free stream. This method had the disadvantage that the metal was somewhat cooled after it had flowed to the opposite side of the mold, and the side against which the trough discharged was apt to become too warm for the aluminum side plate to remain intact at the point of contact therewith. In order not to carry dross from the crucible into the mold the trough had to be placed at an angle of 10 degrees or less from horizontal. This limited the minimum size of mold which could be poured by this method without raising the discharge end of the trough too far above the surface of the metal. For general application this method has therefore been found unsatisfactory.

The primary object of my invention is to provide a method of overcoming the difficulties hereinabove described. A second object is to provide an improved molten metal transfer device which is adapted to deliver a quiet stream of metal and in addition is capable of skimming the dross from the said stream during the transfer. A further object of my invention is to provide a metal transfer device capable of great flexibility in use, both as to the angle of inclination and the relative speed of the transfer. A specific object of my invention is to provide a metal transfer device adapted for use in pouring an ingot mold of the open side type, and particularly in casting ingots of the duplex type. These and other objects and advantages will be more readily understood and appreciated from the following description taken in conjunction with the drawing, in which;

Fig. 1 is a vertical sectional view of my improved transfer device;

Fig. 2 is a somewhat diagrammatic vertical sectional view with parts in elevation, of a casting assembly comprising a transfer device in operative position in a mold of the open side type; and

Fig. 3 is a vertical sectional view on the line III—III in Fig. 2.

Referring to Fig. 1, the preferred form of my transfer device, which is generally designated by the numeral 1, consists essentially of a trough portion 2 to which is rigidly attached the deepened reservoir portion 3. In the reservoir one or more baffle plates 4 are inserted. The baffles fit the sides of the reservoir closely, so that metal flowing through the reservoir must pass between the bottom of the reservoir and the lower edge of the baffle or baffles. A weir 5 is formed in the discharge end of the reservoir. The elevation of the mouth of the weir above the bottom of the reservoir is always greater than the elevation of the lower edge of the baffle 4, but preferably lower than the bottom of the trough 2. This arrangement is an essential feature of my invention, as it keeps the lower edge of the baffle plate beneath the surface of the metal substantially throughout the pouring operation and thus insures the skimming of the dross from the metal passing thereunder. The baffles and the weir, in cooperation with the enlarged reservoir, also tend to retard the velocity and diffuse the force of the stream, which is frequently of importance.

In the construction of this device strength and simplicity are important features. The device is usually made of metal throughout. If protection is needed to avoid attack or solution by the metal transferred, the device may be given a lime wash or other similar coating, or the surfaces may be covered with graphite. In large sizes it may be more convenient to form the reservoir and the trough separately and join them either by welding or by a detachable joint. The baffle plates 4 are usually shaped to wedge between the walls of the reservoir but may be mounted between guides or held in place by any other convenient means.

While my invention is broadly useful in the field of metal founding, and I do not intend that its application should be limited to any particular example, I have chosen to describe its operation in a casting process which is eminently well adapted to bring out its essential and desirable features. The process chosen for example is the casting of aluminum alloy ingots of the duplex type, such as are prepared for rolling into a sheet product, consisting of a strong aluminum alloy center protected on each side by a coating of pure aluminum or an alloy thereof. Ingots of this type are often cast in an open side mold, as stated hereinabove. My invention overcomes the difficulties previously encountered in casting ingots of this type and provides means for quietly delivering dross-free metal to the center of a mold, or to substantially any other desired point in the mold, with a wide flexibility in the angle of the inclination of the trough to the surface of the metal. By my invention the maximum angle of inclination has been increased from about 10 degrees, the previous maximum, to 45 degrees or more from horizontal.

The casting assembly shown in Figs. 2 and 3 consists of an "open side" mold 7 with a flexible side or side-wall 8, which preferably takes the form of an endless belt as shown, and which closes the mold and retains therein a quantity of molten metal 9. The transfer device 1 described hereinabove extends over the flexible side 8 of the mold with the weir 5 and the lower edge of the baffle 4 submerged in the metal 9 contained therein. This device may be pivotally mounted on a support 10 extending upwardly from the floor, or may be suspended from a crane or the like, or otherwise supported. Molten metal is delivered to the transfer device from a crucible 11 or other container. The mold 7 is preferably mounted on a hydraulic piston 13 or other suitable means for raising and lowering the mold as desired. The flexible side 8 is kept tightly in contact with the open side of the mold by spring-mounted rollers or the like (not shown) pressing against the back wall of the mold.

When preparing to pour an ingot of the above-described duplex type by means of my improved method and apparatus, the mold 7 is raised on the piston 13, or the flexible side 8 is relatively lowered by other means, until the top of the flexible side is substantially level with the bottom of the mold. An aluminum or aluminum alloy plate 14 of correct size and predetermined thickness is placed firmly against each side wall of the mold. The transfer device 1 is then positioned so that the reservoir 3 rests on the bottom of the mold, preferably near the center thereof. The trough and reservoir may have any desired angle of inclination from the horizontal, up to about 45 degrees. The molten metal is poured from the crucible 11 into the trough 2, by which it is conducted into and fills the reservoir 3, thus submerging the lower edge of the baffle plates 4. When the reservoir is filled, metal discharges over the weir 5 into the mold. When the level of the metal in the mold rises somewhat above the weir, the transfer device is raised, or preferably the mold is lowered, so as to keep the lower edge of the baffle a small distance under the surface of the metal. The flexible side of the mold is also, of course, progressively raised as the metal rises in the mold. This progressive raising of the transfer device and the flexible side wall relative to the bottom of the mold continues until the mold is filled to the desired extent.

During the flow of the metal through the reservoir and beneath the baffle or baffles dross is skimmed therefrom and arrested by the baffles. The velocity of the stream is also largely reduced by the action of the baffle and the weir discharging beneath the surface of the body of molten metal in the reservoir and mold. Therefore, it has been found in practice that much less skill in pouring is necessary to secure sound ingots by this method. Further, it has been found that the rate of pouring can be varied over a wide range without danger of damaging the side plates 14 or encountering any other difficulties, and that the limiting angle of inclination of the trough is materially increased, as stated hereinabove.

It will be obvious to those skilled in the art of metal founding that my invention may be embodied and applied in forms differing from those described by way of example hereinabove without departing from the spirit of my invention and the scope of the appended claims.

I claim as my invention:

1. Apparatus for transferring molten metal, comprising a trough opening at one end into a reservoir of greater depth than said trough, said reservoir being provided with a transverse downwardly-extending baffle terminating below the level of the bottom of said trough, and having in the end thereof a weir extending upwardly above the lower edge of said baffle.

2. Apparatus for transferring molten metal, comprising a trough closed at one end and opening at the other end into an integral reservoir of greater depth than said trough and of substantially the same width, said reservoir being provided with a transverse downwardly-extending baffle terminating below the level of the bottom of said trough, and having in the end thereof a weir extending upwardly above the bottom of said baffle but terminating below the level of the bottom of said trough.

3. Transfer apparatus for delivering molten metal to a receiver therefor, comprising an in-

clined trough with an enlarged reservoir at one end thereof, a baffle extending downwardly into the reservoir, and a weir at the end of said reservoir, said weir and the lower edge of said baffle being beneath the surface of the molten metal contained in said receiver.

4. Transfer apparatus for delivering molten metal to a receiver therefor, comprising a trough inclined toward the surface of metal in the receiver and having its lower end inserted therein, and a baffle extending downwardly into said trough adjacent said lower end thereof, the lower edge of said baffle being beneath the surface of the metal.

5. The process of casting metal in a mold of the open side type having a flexible wall, which comprises flowing molten metal down an inclined path over the flexible wall of the mold, skimming dross from said metal during its flow along said path, retarding the flow of metal, and quietly discharging substantially dross-free metal substantially at the center of said mold.

6. The process of casting metal in a mold of the open side type having a flexible wall, which comprises flowing molten metal down an inclined path extending over the flexible wall of the mold, skimming dross from said metal during its flow through said path, and quietly discharging substantially dross-free metal over a submerged weir into said mold.

7. The process of casting metal, which comprises flowing molten metal down an inclined path under a baffle which skims dross from the metal and over a weir into a mold, and maintaining the lower edge of the baffle beneath the surface of the metal in the mold substantially throughout the casting operation.

8. The process of casting duplex metal ingots in a mold of the open side type having a flexible wall, which comprises placing metal plates against opposite closed sides of said mold, flowing molten metal down an inclined path over the said flexible wall, skimming dross from the molten metal during its flow along said path by passing it under a fixed downwardly-extending baffle, and quietly discharging substantially dross-free metal over a submerged weir substantially at the center of the mold.

EDWARD M. CHANDLER.

Dec. 11, 1934. W. T. ENNOR ET AL 1,983,579

METAL TRANSFER SYSTEM

Filed Dec. 3, 1932

Fig. 4.

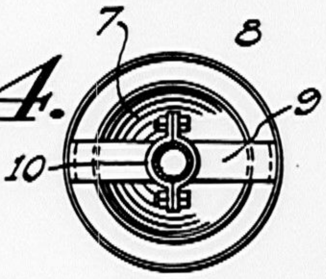


Fig. 2.

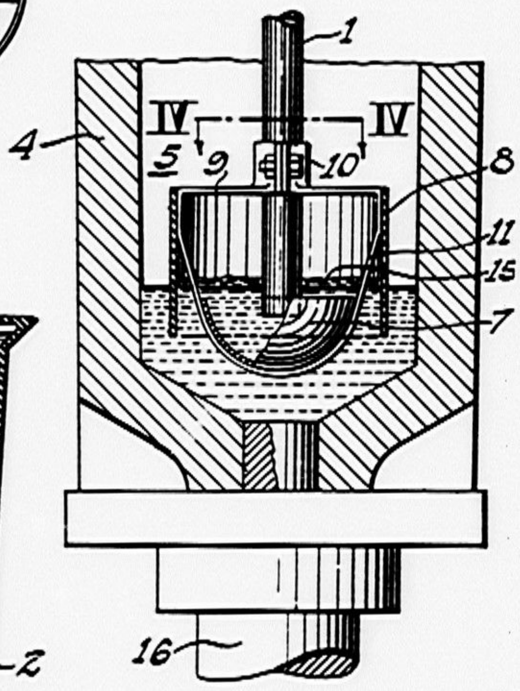


Fig. 5.

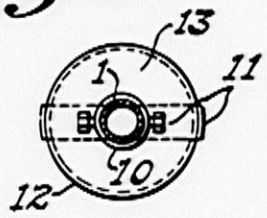


Fig. 1.

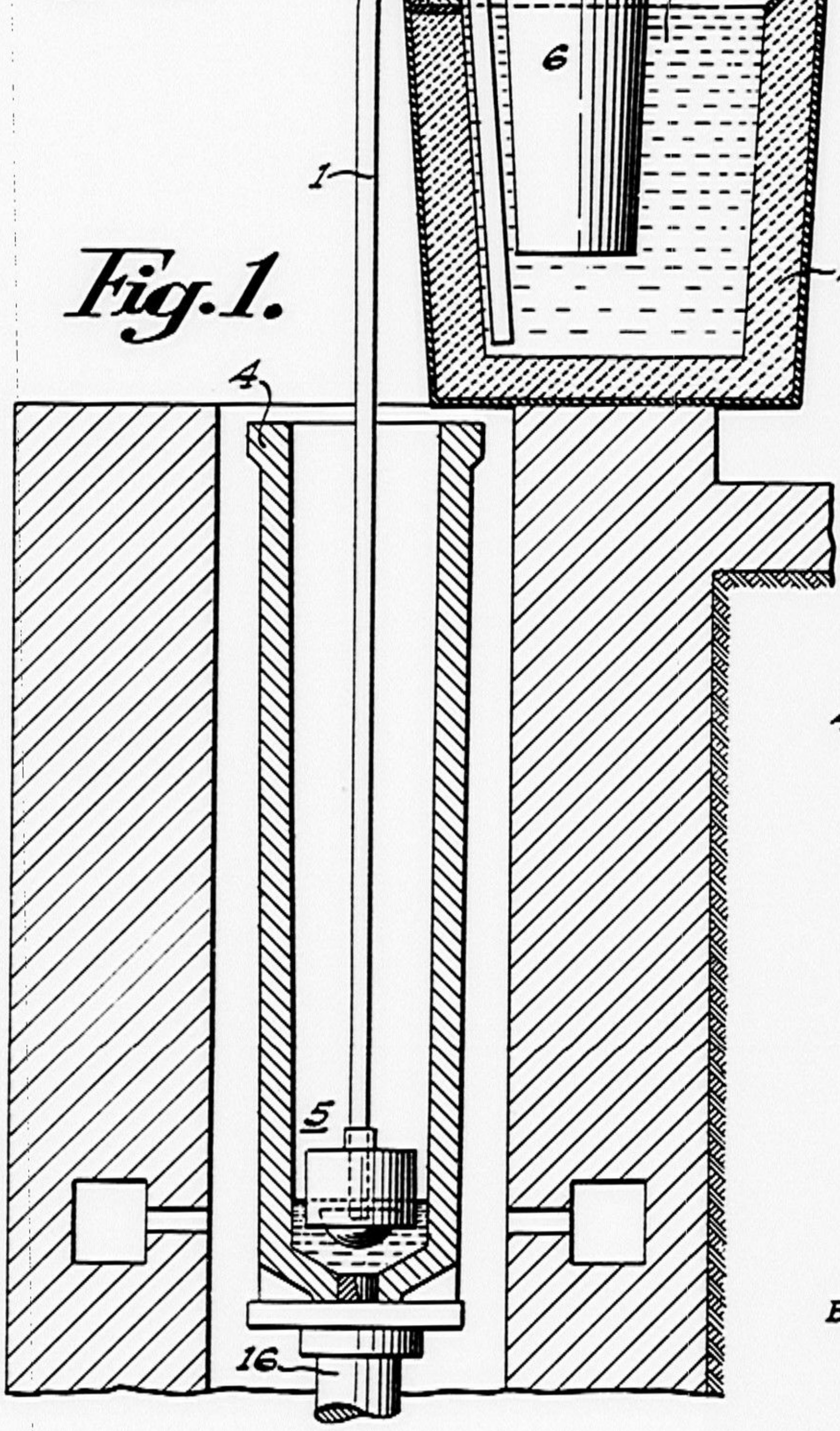
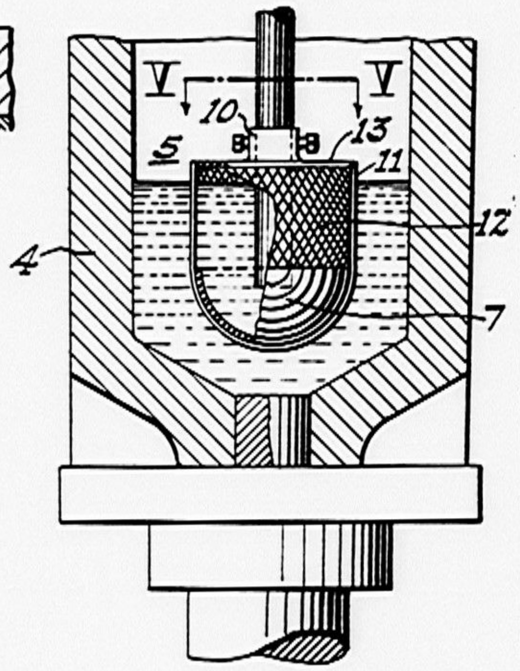


Fig. 3.



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UNITED STATES PATENT OFFICE

1,983,579

METAL TRANSFER SYSTEM

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Application December 3, 1932, Serial No. 645,508

13 Claims. (Cl. 22—79)

This invention relates to the transfer of molten metal. It relates particularly to a new and improved system for the transfer of molten metal from one container to another, such as from a crucible to an ingot mold, for example.

The primary object of our invention is to provide an improved transfer apparatus or system for delivering a quiet flow of substantially dross-free metal.

Our invention contemplates accomplishing this and other objects which will be apparent from the following description and claims, in a simple and economical manner by the use of apparatus simple in construction and easy to keep clean and in operating order. In order that the nature of our invention may be more readily understood, it will now be described with reference to the accompanying drawing in which;

Figure 1 is a diagrammatic view in vertical section, with parts in elevation, of apparatus comprising a preferred embodiment of our invention in operative position;

Figure 2 is an enlarged sectional view of part of the apparatus shown in Fig. 1;

Figure 3 is a similar view of another embodiment of our invention;

Figure 4 is a plan view taken along the line IV—IV in Fig. 2; and

Figure 5 is a plan view taken along the line V—V in Fig. 3.

Like reference numerals have been used to designate like parts throughout the drawing.

The casting assembly shown in Fig. 1 consists of a siphon 1 connecting a crucible 2, containing molten metal 3, with a mold 4, a device 5 being associated with the siphon for collecting and removing dross from the metal transferred and diffusing the force of the flowing metal. Two forms of this device are shown in more detail in Figs. 2 and 3. The crucible 2 is equipped with means for starting the operation of the siphon, consisting preferably of a displacement device or member 6, which is adapted to be rapidly inserted in the molten metal in the crucible to temporarily raise its level above the level of the highest point of the siphon, thereby starting the flow of the metal through the siphon. The siphon is usually luted in position in a notch in the crucible wall, as shown in Fig. 1.

The diffusing and dross-collecting device 5, in the form shown in Figure 2, consists essentially of a substantially hemispherical bowl 7 positioned beneath the discharge end of the siphon 1, and means for collecting dross separating from the metal transferred, in the form of a plate or baffle 8 surrounding the pipe and bowl. As shown in Figs. 1 and 2, the end of the discharge pipe and the lower edge of baffle 8 extend below the surface of the metal contained in the mold or other receiving vessel 4, and the bowl 7 is completely submerged beneath the surface of the metal. The baffle 8 is usually supported by two or more ribs 9 extending from a clamp ring 10 on the discharge pipe 1. The bowl may be suspended from the ribs 9 or the clamp 10 by two or more rods or metal straps 11. Both the baffle and the bowl may be supported in any other convenient manner, but while not essential, it is preferable to arrange these parts in fixed relation to each other and to the discharge pipe prior to using. In the preferred relation or position of parts, the lower edge of the baffle 8 extends somewhat below the end of the discharge pipe, and the bowl 7 is placed with its edge surrounding and extending somewhat above the end of the discharge pipe. This relative position may be varied, however.

Another form of diffusing and dross-collecting device is shown in Figure 3. The bowl 7 positioned under the discharge pipe is similar to the bowl used in the alternative form hereinabove described. The essential difference between the two forms lies in the form of baffle employed for collecting the separated dross. In place of a solid baffle plate dipping below the surface of the metal, we use a screen or perforate member 12, which is preferably coextensive and concentric with the edge of the bowl 7, on which it rests. This screen may be provided with a solid cover 13, so that the device can, if desired, be totally immersed in the metal in the mold without permitting dross to escape over its top. The bowl can be conveniently supported by means of ribs 11 extending from the cover 13, which is usually fastened to the discharge pipe 1, or extending from the pipe if a cover is not used.

In the first-described form of diffusing and dross-collecting device, the bowl 7 and the imperforate cylinder or baffle 8 are customarily fabricated from metal plate, and in the device shown in Fig. 3 we have found it preferable to employ a screen or perforate member 12 made from "stainless steel" or "stainless iron", especially when the device is used for transferring molten aluminum. At times it may be necessary to protect the metal parts from attack or solution by the metal being transferred, and in that case part or all of the apparatus, including the siphon itself, may be given a lime wash. This is done by heating the apparatus somewhat above the boiling point of water and treating the heated surface with a slurry of lime. Before use the apparatus is again heated sufficiently to drive off any moisture remaining on the surface or in the coating.

The operation of both forms of the diffusing and collecting device 5 is substantially the same. The metal discharged from the siphon impinges on the inner surface of a concave bowl 7 and the direction of its flow is substantialy reversed, causing diffusion of the metal and producing a gentle rolling motion, which expedites the separation of dross entrained in the metal. With the device shown in Fig. 2, the separated dross 15 is collected on the surface of the metal in the receiver and held in the annular space between the discharge pipe and the baffle 8. Upon withdrawal of the transfer apparatus from the receiver 4, the dross not removed in the bowl 7 floats on the surface of the metal in the receiver in a compact mass and can be readily removed. With the device shown in Fig. 3, the dross is separated from the metal by a screen 12 and collects within the screen, and is removed from the receiver when the transfer apparatus is removed.

The operation of a casting assembly embodying our invention will now be readily understood. The siphon 1 or other transfer device, which preferably terminates in a vertical discharge pipe, is positioned, by means of an overhead crane or the like, to discharge into the mold or receiver 4. If the mold is empty, the discharge pipe is inserted therein until the device 5 is on or near the bottom of the mold, and if the mold is partly filled the discharge pipe is inserted until its end is below the surface of the metal. The bowl 7 positioned under the discharge pipe is then, of course, entirely submerged. When using a diffusing device of the type shown in Fig. 2, the lower edge of the cylinder or baffle 8 also extends below the surface of metal in the mold, either when starting the flow or very soon after starting it, so that the metal turned upwardly by impingment on the concave surface of the bowl 7 must then flow downwardly beneath the edge of the cylinder 8 into the mold. As the metal fills the receiver the transfer device is gradually raised, or preferably the receiver is lowered by means of a piston 16 or its equivalent, care being taken that the lower edge of the baffle 8 (if used), and preferably the lower end of the discharge pipe, are always beneath the surface of the metal. When the casting operation is complete the transfer device is removed, and any dross not removed therewith remains in a compact mass floating on the surface of the molten metal in the receiver, from which it is easily skimmed with a ladle.

Our diffusing and dross-collecting devices may take forms other than the two shown and described without materially changing the operation of metal transfer systems in which they are employed. While such devices are especially advantageous when employed with siphons or other transfer means of the vertical discharge type, they may readily be adapted for use with other types of transfer devices, including those types in which the transfer or discharge member is substantially horizontal. The size, both relative and absolute, and the relative position of the elements of our improved metal transfer system, may be varied in accordance with the amount of metal to be transferred and the desired rate of transfer. Our invention is therefore not limited to the exact structure and relative dimensions disclosed herewith, but may be variously embodied within the scope of the following claims.

We claim:

1. A molten metal transfer system comprising a container for molten metal, a receiver for molten metal, a siphon adapted to deliver molten metal from said container into said receiver, means adapted to start a flow of molten metal through said siphon, and means associated with the discharge end of said siphon adapted to diffuse metal and collect dross delivered by the siphon.

2. In a molten metal transfer system, a container for molten metal, a receiver for molten metal, a siphon adapted to transfer molten metal from said container to said receiver, and means positioned within said receiver and adjacent the discharge end of said siphon for diffusing metal and collecting dross discharged by said siphon.

3. In a molten metal transfer system, a receiver for molten metal, a siphon having a discharge pipe extending into said receiver, a concave member positioned to receive metal discharge by said pipe and adapted to substantially reverse the direction of its flow, and means cooperating with said concave member to collect dross discharged with the metal.

4. In a molten metal transfer system, a discharge pipe, means positioned to receive metal discharged by said pipe and adapted to substantially reverse the direction of its flow, and a member extending above said means and downwardly at least to the top thereof and cooperating therewith to collect dross discharged with the metal.

5. In a molten metal transfer system, a discharge pipe, a concave member having edges surrounding and extending above the end of said discharge pipe, and a device at least co-extensive with said concave member and extending above the edges thereof and adapted to collect dross.

6. In a molten metal transfer system, a discharge pipe, a substantially circular concave member positioned to receive metal discharged by said pipe and having edges extending above the end of said pipe, and a substantially circular baffle extending above said concave member and having a diameter at least as great as the diameter of said member.

7. In a molten metal transfer system, a discharge pipe, a member with a concave surface positioned to receive the discharge from said pipe and adapted to substantially reverse the direction of its flow, and a cooperating member extending upwardly above and downwardly at least as far as the edge of said member with a concave surface and adapted to collect dross, at least one of said members being supported by the discharge pipe.

8. In a molten metal transfer system, in combination with a receiver containing molten metal, a discharge pipe extending into said receiver, a concave member positioned beneath the surface of the metal in said receiver and adapted to substantially reverse the direction of flow of metal discharged by said pipe, and means cooperating therewith for collecting dross discharged by said pipe.

9. In a molten metal transfer system, in combination with a receiver containing molten metal, a discharge pipe extending into said receiver, a concave member positioned beneath the surface of the metal in said receiver and adapted to substantially reverse the direction of flow of metal discharged by said pipe, and a device at least coextensive with said concave member and extending beneath the surface of the metal and

adapted to collect dross discharged by said pipe.

10. In a molten metal transfer system, in combination, a discharge pipe and a diffusing and dross-collecting device, said device comprising a concave member positioned to receive molten metal discharged by said pipe and adapted to substantially reverse the direction of its flow, and a baffle surrounding said concave member and adapted to collect dross.

11. In a molten metal transfer system, in combination, a discharge pipe and a diffusing and dross-collecting device, said device comprising a concave member positioned to receive molten metal discharged by said pipe and adapted to substantially reverse the direction of its flow, and a perforate member extending upwardly from the edge of said concave member and adapted to collect dross.

12. In a molten metal transfer system, a receiver containing molten metal, a discharge pipe extending into said receiver and terminating beneath the surface of metal therein, a concave member submerged beneath the surface of said metal with its edge extending above and surrounding the end of said discharge pipe, and a concentric baffle extending below the edge of said concave member and above the surface of the metal.

13. In a molten metal transfer system, a receiver containing molten metal, a discharge pipe extending into said receiver and terminating beneath the surface of metal therein, a concave member submerged beneath the surface of said metal with its edge extending above and surrounding the end of said discharge pipe, and a concentric perforate member extending upwardly from the edge of said concave member.

WILLIAM T. ENNOR.
WILLIAM E. KING.

115

Stipulation

Filed April 18 1939

* * *

It is hereby stipulated by and between the solicitors for the parties to the above entitled action that the record on appeal, which is to be prepared by the Clerk of the United States District Court for the District of Columbia, shall include copies of the following:

1. Bill of Complaint
2. Answer to Bill of Complaint
3. Memorandum Opinion of Justice Daniel W. O'Donoghue (if any)
4. Findings of Fact and Conclusions of Law
5. Judgment
6. Notice of Appeal
7. Transcript of the evidence (testimony of Daniel L. Ogden and Robert Winters) and the exhibits offered in evidence by the plaintiffs and by the defendant.

JOSEPH H. MILANS
Solicitor for the Plaintiffs.

R. F. WHITEHEAD
Solicitor for the Defendant.

116 District Court of the United States for the District of Columbia

UNITED STATES OF AMERICA,
District of Columbia, ss:

I, Charles E. Stewart, Clerk of the District Court of the United States for the District of Columbia, hereby certify the foregoing pages numbered from 1 to 115, both inclusive, to be a true and correct transcript of the record, according to directions of counsel herein filed, a copy of which is made part of this transcript, in cause No. 64962 in Equity, wherein William F. Eppensteiner, et al., are Plaintiffs and Conway P. Coe, Commissioner of Patents, is Defendant, as the same remains upon the files and of record in said Court.

In Testimony Whereof, I hereunto subscribe my name and affix the seal of said Court, at the City of Washington, in said District, this 29th day of April, 1939.

C. E. STEWART,
(Seal) *Clerk.*

Endorsed on Cover: No. 7395 Eppensteiner et al., Appellants, v. Coe. United States Court of Appeals for the District of Columbia Filed May 1-1939 Joseph W. Stewart, Clerk.